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List of Fellows

OF THE

ENTOMOLOGICAL SOCIETY OF LONDON.

HONORARY FELLOWS.

Date of Election.

1900 Aurivillius, Professor Christopher, *Stockholm.*

1915 Berlese, Professor Antonio, *via Romana*, 19, *Firenze, Italy.*

1905 Bolivar, Ignacio, *Museo nacional de Historia natural, Hipodromo*, 17, *Madrid.*

1911 Comstock, Prof. J. H., *Cornell University, Ithaca, New York, U.S.A.*

1894 Forel, Professor Auguste, M.D., *Yvorne, Canton de Vaud, Switzerland.*

1898 Grassí, Professor Battista, *The University, Rome.*

1915 ‡ Howard, Dr. L. O., *Chief, Bureau of Entomology, U.S. Dept. of Agriculture, Washington, U.S.A.*

1914 Lameere, Professor A., 74, *rue Defacq, Bruxelles.*

1918 Marchal, Dr. Paul, President of the Entomological Society of France, 45, *rue de Verrières, Antony, Seine, France.*

1908 Oberthür, Charles, *Rennes, Ille-et-Vilaine, France.*

1913 Tian-Shanski, A. P. Semenoff, *Vassili Ostrov*, 8 *lin.*, 39, *Petrograd, Russia.*

1911 Wasmann, Fr. Erich, S.J., *Valkenburg (L.) Ignatius Kolleg, Holland.*

SPECIAL LIFE FELLOWS.

Date of Election.

1916 * (1894) Miall, Louis Compton, F.R.S. (Council, 1903, 1908), *Norton Way, N., Letchworth.*

1921 (1862) Sharp, David, M.A., M.B., F.R.S., F.L.S., F.Z.S. (Pres., 1887–8; V.-Pres., 1889, 1891–2, 1896, 1902–3; Sec., 1857; Council, 1893–5, 1902–4), *Lawnside, Brockenhurst, Hants.*

1916 (1888) Yerbury, Colonel John W., late R.A., F.Z.S. (Council, 1896, 1903–5), 2, *Ryder-street, St. James's*, S.W. 1.

FELLOWS.

(The names of those who have not yet paid either the Entrance Fee or the first year's subscription are not included.)

Marked * *died during the year* 1921.
Marked † *have compounded for their Annual Subscriptions.*
Marked ‡ *have been admitted into the Society (to Dec.* 1921).

Date of Election.

1914 †‡ Adair, E. W., B.A., *Turf Club, Cairo, Egypt.*

1913 ‡ Adams, B. G., 15, *Fernshaw-road, Chelsea*, S.W.

1902 ‡ Adkin, Benaiah Whitley, *Trenowth, Hope-park, Bromley, Kent.*

1885 ‡ Adkin, Robert (Council, 1901–2, 1911–13, 1921–), *Hodeslea, Meads, Eastbourne.*

1921 Alexander, Prof. C. P., 419, *West Main-street, Urbana, Illinois, U.S.A.*

1912 Allen, J. W., M.A., 266, *Willesden-lane, London, N.W. 2.*

1920 ‡ Altson, A. M., 26 *Addison Mansions, Blythe-road, W. Kensington, W. 14.* All communications to *College of Science, Entomological Department, Exhibition-road, S.W. 7.*

1911 Anderson, T. J., *Entomological Laboratory, Kabete, Brit. E. Africa.*

1919†‡Andrewes, Christopher Howard, 1, *North-grove, Highgate, N. 6.*

1910†‡Andrewes, H. E. (Council, 1920–21), 8, *North-grove, Highgate, N. 6.*

1899 ‡ Andrews, Henry W., *Woodside, Victoria-road, Eltham, S.E. 9.*

1901 ‡ Anning, William, 39, *Lime Street, E.C. 3.*

1908 † Antram, Charles B., *Somerdale Estate, Ootacamund, Nilgiri Hills, S. India.*

1913 ‡ Armytage, Edward O., *Ingleby, Armytage, Victoria, Australia.*

1907 ‡ Arnold, G., D.Sc., A.R.C.S., *Rhodesia Museum, Bulawayo, South Africa.*

1899†‡Arrow, Gilbert J. (Council 1905–7), 9, *Rossdale-road, Putney, S.W. 15* ; and *British Museum (Natural History), Cromwell-road, S.W. 7.*

1911‡Ashby, Edward Bernard, 36, *Bulstrode-road, Hounslow, Middlesex.*

1907†‡Ashby, Sidney R., 8, *Elm Tree-road, St. John's Wood, N.W. 8.*

1921 Atkinson, Dennis Jackson, *Ataran Forest Division, Moulmein, Burma.*

1886 Atmore, E. A., 48, *High-street, King's Lynn.*

1914 Awati, P. R., Medical Entomologist, c/o Grindlay & Co., Bankers, 26, *Westmorland-street, Calcutta.*

1901 ‡ Bacot, Arthur W. (Council, 1916–18), *York Cottage, York-hill, Loughton, Essex.*

1904†‡Bagnall, Richard S., 5, *Higham Place, Newcastle-on-Tyne.*

1909 ‡ Bagwell-Purefoy, Capt. Edward, *East Farleigh, Maidstone.*

1916 ‡ Balfour, Miss Alice, 4, *Carlton-gardens, S.W.*, and *Whittinghame, Prestonkirk, Scotland.*

1921 ‡ Balfour-Browne, F. M., F.R.S.E., F.Z.S., *Oaklands, Fenstanton, St. Ives, Hunts.*

1912 Ballard, Edward, Govt. Entomologist, *Agricultural College and Research Institute, Coimbatore, Madras, S. India.*

1886 ‡ Bankes, Eustace R., M.A.

1890 Barclay, Francis H., F.G.S., *The Warren, Cromer.*

1895 Barker, Cecil N., 81, *Bellevue-road, Durban, Natal, South Africa.*

1920 ‡ Barns, Thomas Alexander, F.Z.S., 32, *Windsor-court, Bayswater, W. 2.*

1902 ‡ Barraud, Philip J., *Central Research Institute, Kasauli, Punjab, India.*

1907 ‡ Bartlett, H. Frederick D., 1, *Myrtle-road, Bournemouth.*

1894 †‡Bateson, Prof. William, M.A., F.R.S., Fellow of St. John's College, Cambridge, *The Manor House, Merton, Surrey.*

1908 Bayford, E. G., 2, *Rockingham-street, Barnsley.*

1904 Bayne, Arthur F., c/o Messrs. Freeman, *Castle-street, Framlingham, Suffolk.*

1912 ‡ Baynes, Edward Stuart Augustus, 39, *Rowland Gardens,* S.W. 7.

1896 †‡Beare, Prof. T. Hudson, B.Sc., F.R.S.E. (V.-Pres., 1910; Council, 1909–11), 10, *Regent Terrace, Edinburgh.*

1908 ‡ Beck, Richard, 97, *Pelton St., Barnstaple.*

1912 Bedford, Gerald, Entomologist to the Union of South Africa, Veterinary Bacteriological Laboratory, *Ondestepoort, Pretoria, Transvaal.*

1913 Bedford, Capt. Hugh Warren, *W.T.R. Laboratories, Khartoum, Sudan.*

1899 ‡ Bedwell, Ernest C. (Council, 1917–19, 1922–), *Bruggen, Brighton-road, Coulsdon, Surrey.*

1920 ‡ Beeson, C. F. C., *Indian Forest Service, Forest Research Institute, Dehra Dun, U.P., India.*

1904 Bengtsson, Simon, Ph.D., Lecturer, *University of Lund, Sweden;* Curator, Entomological Collection of the University.

1915 Benham, Prof. William Blaxland, M.A., D.Sc., F.R.S., *University of Otago, Dunedin, New Zealand.*

1906 ‡ Bentall, E. E., *The Towers, Heybridge, Essex.*

1913 ‡ Best-Gardner, Charles C., *Rookwood, Neath, Glamorgan.*

1920 ‡ Bethell, George, F.R.Hist.S., F.L.A., 11, *Chandos-street,* W. 1.

1885 ‡ Bethune-Baker, George T., F.L.S., F.Z.S. (Pres., 1913–14; V.-Pres., 1910–11, 1915; Council, 1895, 1910–15, 1919–21), 20, *Newbold Terrace, Leamington Spa.*

1918 Beveridge, Brigadier-Gen. W. W. O., C.B., D.S.O., R.A.M.C., 30, *South Eaton-place,* S.W. 1.

1891 ‡ Blaber, W. H., F.L.S., 34, *Cromwell-road, Hove, Brighton.*

1904 ‡ Black, James E., F.L.S., *Nethercroft, Peebles.*

1920 Blackmore, E. H., Pres. Brit. Columbia Ent. Soc., *P.O. Box* 221, *Victoria, B.C.*

1904 ‡ Blair, Kenneth G. (Council, 1918–20), *Claremont,* 120, *Sunningfields-road, Hendon,* N.W. 4.

1921 Blenkarn, S. A., 44, *Romola-road, Herne Hill,* S.E. 24.

1904 ‡ Bliss, Maurice Frederick, M.C., M.R.C.S., L.R.C.P., 130, *High Town road, Luton, Beds.*

1916 ‡ Bocock, Charles Hanslope, *The Elms, Ashley, Newmarket.*

1912 Bodkin, G. C., Govt. Entomologist, *Georgetown, British Guiana.*

1903 Bogue, W. A., *The Bank House, Watchet.*

1911 Boileau, H., 99, *Rue de la Côte St. Thibault, Bois de Colombes, Seine, France.*

1921 Bolton-King, E., *Balliol College, Oxford.*

1891 Booth, George A., F.Z.S., M.B.O.U., *The Hermitage, Kirkham, Lancs.*

1902 ‡ Bostock, E. D., *Oulton Cross, Stone, Staffs.*
1921 Bouck, Baron J., *Springfield, South Godstone, Surrey.*
1913 Bowater, Lieut.-Col. William, 23, *Highfield-road, Edgbaston, Birmingham.*
1894 † Bowles, E. Augustus, M.A., *Myddelton House, Waltham Cross.*
1912 † Bowring, C. Talbot, Commissioner of Customs, *Ichang, China.*
1921 ‡ Box, H. E., 150, *Stamford Hill,* N. 16.
1919 ‡ Box, Lieut. L. A., 35, *Great James-street,* W.C. 1.
1910 Boyd, A. Whitworth, *Frandley House, nr. Northwich.*
1920 Boyd, Major John Erroll Moritz, M.C., R.A.M.C., *Pendavey, Birchington-on-Sea.*
1905 Bracken, Charles W., B.A., 5, *Carfrae Terrace, Lipson, Plymouth.*
1919 Bradley, Prof. J. Chester, M.Sc., Professor of Entomology and Curator of Invertebrate Zoology, *Cornell University, Ithaca, New York, U.S.A.*
1917 Breijer, Dr. H. G., Ph.D., Director of the Transvaal Museum, *Pretoria, Transvaal, S. Africa.*
1920 ‡ Brenchley, Dr. Winifred E., D.Sc., F.L.S., *Rothamsted Experimental Station, Harpenden, Herts.*
1920 ‡ Bridson, Miss Mary Francis Cossart, *Ford Brow, Dartmouth.*
1894 ‡ Bright, Percy M., *Colebrook Grange,* 58, *Christchurch road, Bournemouth.*
1909 Britten, Harry, 22, *Birch-grove, Levenshulme, Manchester.*
1902 ‡ Broughton, Lt.-Col. T. Delves, R.E., *D.A.D.W. Office, Wellington, Nilgiris, India.*
1904 ‡ Brown, Henry H., 5, *Bruntsfield-crescent, Edinburgh.*
1919 Brown, James Meikle, B.Sc., F.I.S., F.C.S., 176, *Carterknowe-road, Millhouses, Sheffield.*
1910 Browne, Horace B., M.A., *Kenilworth, Scatcherd-lane, Morley, Yorks.*
1911 * Brutzer, Rev. Henry W., *Upton Vicarage, Peterborough.*
1909 Bryant, Gilbert E., 163, *Gloucester terrace, Hyde Park,* W. 2.
1898 † Buchan-Hepburn, Sir Archibald, Bart., J.P., D.L., *Smeaton-Hepburn, Prestonkirk.*
1919 ‡ Buckhurst, A. S., 9, *Souldern-road,* W. 14.
1917 ‡ Buckley, Dr. George Granville, M.D., F.S.A., *Rye Croft South, Manchester-road, Bury, Lancs.*
1916 Bugnion, Prof. E., *La Luciole, Aix-en-Provence, France.*
1907 Bulleid, Arthur, F.S.A., *Dimboro, Midsomer Norton, Somersetshire.*
1919 ‡ Bunnett, E. J., M.A., 19, *Silverdale-road, Sydenham,* S.E. 26.
1896 † ‡ Burr, Malcolm, D.Sc., F.L.S., F.Z.S., F.G.S., A.R.S.M. (V.-Pres., 1912; Council, 1903, 4, 1910–12), *United University Club, Pall Mall East,* S.W. 1.
1920 Burras, Alfred Ellis, 3, *Connaught-road, North End, Portsmouth.*
1909 ‡ Burrows, The Rev. C. R. N., *The Vicarage, Mucking, Stanford-le-Hope, Essex.*
1920 ‡ Bushell, Capt. H. S., *Imperial Bureau of Entomology,* 41, *Queen's Gate, S. Kensington,* S.W. 7, and *Ravensholt, Harrow-on-the-Hill.*

1868†‡Butler, Arthur G., Ph.D., F.L.S., F.Z.S. (Sec., 1875; Council, 1876), *The Lilies, Beckenham-road, Beckenham.*

1883 ‡ Butler, Edward Albert, B.A., B.Sc. (Council, 1914–16), 35, *Kyrle-road, West Side, Clapham Common.*

1902 ‡ Butler, William E., *Hayling House, Oxford-road, Reading.*

1905 ‡ Butterfield, James A., B.Sc., *Ormesby, 21, Dorville-road, Lee, S.E.*

1914 † Butterfield, Rosse, Curator, *Corporation Museum, Keighley, Yorks.*

1912†‡Buxton, Patrick Alfred, M.B.O.U., *Dept. of Health, Government House, Jerusalem.*

1917 Cameron, Alfred E., M.A., D.Sc., *University of Saskatchewan, Saskatown, Canada.*

1902 ‡ Cameron, Malcolm, M.B., R.N. (Council, 1919–20), *Forest Research Institute, Dehra Dun, U.P., India.*

1885 * Campbell, Francis Maule, F.L.S., F.Z.S., etc., *Kilronan, South Nutfield, Surrey.*

1898 Candèze, Léon, *Mont St. Martin* 75, *Liège.*

1880 Cansdale, W. D., *Sunny Bank, South Norwood*, S.E. 25.

1889 ‡ Cant, A., 33, *Festing-road, Putney*, S.W. 15.

1910 Carlier, E. Wace, M.D., F.R.S.E., *Morningside, Granville-road, Dorridge*, and *The University, Birmingham.*

1892 ‡ Carpenter, The Hon. Mrs. Beatrice, 22, *Grosvenor-road*, S.W. 1.

1919 Carpenter, Cyril F., 230½, *13th Street, Sacramento, California, U.S.A.*

1910 ‡ Carpenter, Geoffrey D. H., D.M., B.Ch., *c/o P.M.O., Uganda.*

1895 ‡ Carpenter, Prof. George H., B.A., D.Sc., *Royal College of Science, Dublin.*

1915 Carr, Professor John Wesley, M.A., F.L.S., F.G.S., Professor of Biology, *University College, Nottingham.*

1912 Carter, Henry Francis, Assistant Lecturer and Demonstrator in Medical and Economic Entomology, 7, *Courthope Villas, Worple-road, Wimbledon*, S.W. 19. All communications to *The Bacteriological Institute, Colombo.*

1906 ‡ Carter, H. J., B.A., *Garrawillah, Kintore-street, Wahroonga, Sydney, N.S.W.*

1921 Casling, P. V., *c/o* Alliance Bank of Simla, *Peshawar, India.*

1921 Cassels, O. C., D.F.C., N.D.A., Hon. Dip. (Harper-Adams A. C.), *La Cumbre, Ottery St. Mary, Devon.*

1889†‡Cave, Charles J. P., *Stoner Hill, Petersfield.*

1920 ‡ le Cerf, F., Curator of the Lepidoptera in the Paris Museum, 13, *rue Guy de la Brosse, Paris.*

1900 Chamberlain, Neville, *Westbourne, Edgbaston, Birmingham.*

1871 ‡ Champion, George C., F.Z.S., A.L.S. (Librarian, 1891–1920; Council, 1875–7, 1921); *Heatherside, Horsell, Woking;* and 45, *Pont-street*, S.W. 1.

1914 ‡ Champion, Harry George, B.A., Assistant Conservator of Forests, *W. Almora, U.P., India.*

1891*‡Chapman, Thomas Algernon, M.D., F.R.S., F.Z.S. (V.-Pres., 1900, 1904–5, 1908, 1916–17; Council, 1898–1900, 1903–5, 1907–9, 1916–18), *Betula, Reigate.*

1919 Chatterjee, Nibavan Chandra, B.Sc., *Forest Research Institute, Dehra Dun, U.P., India.*

1897 ‡ Chawner, Miss Ethel F., *Forest Bank, Lyndhurst S.O., Hants.*

1913 ‡ Cheavin, Capt. W. H. S., F.C.S., F.R.M.S., F.N.P.S., Demonstrator, Chemistry Dept., Middlesex Medical College, *Middlesex Hospital Medical School*, W. 1.

1919 Cheesman, Miss L. Evelyn, *Entomological Dept., Zoological Society, Regent's Park*, N.W. 8.

1920 ‡ Cheetham, Christopher Arthington, *Wheatfield, Old Farnley, Leeds.* All communications to *Stone Bridge Mills, Wortley, Leeds.*

1889 Christy, William M., M.A., F.L.S., *Watergate, Emsworth.*

1914 Chrystal, R. Neil, B.Sc., *Royal Botanic Gardens, Kew, Surrey,* and 4, *Branstone-road, Kew, Surrey.*

1909 Clark, Lt.-Col. C. Turner, F.Z.S., *Hillcrest, St. Augustine's-avenue, S. Croydon.*

1914 Cleare, L. D., *Berbice, British Guiana.*

1914 Cleghorn, Miss Maude Lina West, F.L.S., 12, *Alipore-road, Calcutta, India.*

1908 Clutterbuck, Charles G., *Heathside*, 23, *Heathville-road, Gloucester.*

1908 Clutterbuck, P. H., Inspector General of Forests, *Simla, India.*

1904 ‡ Cockayne, Edward A., M.A., M.D., F.R.C.P. (Council, 1915–17), 65, *Westbourne-terrace*, W. 2.

1920 Cockcroft, T., 111, *Owen-street, Wellington South, New Zealand.*

1917 ‡ Cockerell, Prof. T. D. A., *University of Colorado, Boulder, Colorado, U.S.A.*

1917 ‡ Cocks, Frederick, 26, *Crown-street, Reading.*

1914 Coleman, Leslie C., Dept. of Agriculture, *Bangalore, Mysore, India.*

1899 ‡ Collin, James E. (V.-Pres., 1913; Council, 1904–6, 1913–15, 1922–), *Sussex Lodge, Newmarket.*

1918 Comstock, Dr. John Adams, the Director, South-Western Museum, *Marmion-way and Avenue, Los Angeles, California, U.S.A.*

1913 ‡ Coney, Miss Blanche A., *Brampton Hall, Wangford, Suffolk.*

1919 ‡ Constable, Miss Florence B., 17, *Colville Mansions*, W. 11.

1921 Coote, F. D., 11, *Pendle-road, Streatham*, S.W.

1916 Cornford, The Rev. Bruce, 13, *Havelock-road, Portsmouth.*

1920 ‡ Cotterell, G. S., *Newlyn, Gerrard's Cross, Bucks.*

1913 Coward, Thomas Alfred, F.Z.S., 36, *George-street, Manchester.*

1920 ‡ Crabbe, E., 52, *Sarsfeld-road, Balham*, S.W. 12.

1895 Crabtree, Benjamin Hill, *Holly Bank, Alderley Edge, Cheshire.*

1913 Cragg, Major F. W., M.D., I.M.S., *Central Research Institute, Kasauli, Punjab, India.*

1919 Crampton, Prof. E. Chester, *Massachusetts Agricultural College, Amherst, Mass., U.S.A.*

1909 ‡ Crawley, W. C., B.A., F.R.M.S. (Council, 1917–19), 29, *Holland Park-road*, W. 14.
1890 Crewe, Sir Vauncey Harpur, Bart., *Calke Abbey, Derbyshire.*
1907 ‡ Croft, Edward Octavius, M.D., 12, *North Hill-road, Headingley, Leeds.*
1919 ‡ Cumming, Bernard Douglas, *Boulderwall, East Hill-road, Oxted.*
1908 Curtis, W. Parkinson, *Drake North, Sandringham-road, Parkstone, Dorset.*

1900 Dalglish, Andrew Adie, 7, *Keir-street, Pollokshields, Glasgow.*
1886 ‡ Dannatt, Walter, F.Z.S., *St. Lawrence, Guibal-road, Lee*, S.E.
1911 Davey, H. W., Inspector of Department of Agriculture, *Melbourne, Victoria, Australia.*
1913 Davidson, James, D.Sc., F.L.S., *Institute of Plant Pathology, Rothamsted, Harpenden, Herts.*
1905 Davidson, James, 32, *Drumsheugh Gardens, Edinburgh.*
1912 Davis, Frederick Lionel, J.P., M.R.C.S., L.R.C.P., *Corosal, British Honduras.*
1910 ‡ Dawson, William George, *Shortlands House, Shortlands, Kent.*
1903 Day, F. H., 26, *Currock-terrace, Carlisle.*
1898 Day, G. O., *Sahlatston, Duncan's Station, Vancouver Island, British Columbia.*
1917 ‡ Dicksee, Arthur, 24, *Lyford-rd., Wandsworth Common*, S.W. 18.
1887 ‡ Dixey, Frederick Augustus, M.A., M.D., F.R.S., Fellow and Bursar of Wadham College (Pres., 1909–10; V.-Pres., 1904–5, 1911; Council, 1895, 1904–6), *Wadham College, Oxford.*
1921 Dobson, H. W., 14, *Finkle-street, Kendal.*
1909 † Dobson, Thomas, 33, *The Park, Sharples, Bolton.*
1905 Dodd, Frederick P., *Kuranda, viâ Cairns, Queensland.*
1912 ‡ Doig, Major Kenneth Alan Crawford, R.A.M.C., M.R.C.S., L.R.C.P., 3, *Hook Heath, Woking.*
1891 ‡ Donisthorpe, Horace St. John K., F.Z.S. (V.-Pres., 1911; Council, 1899–1901, 1910–12), *Durandesthorpe*, 19, *Hazlewell-road, Putney*, S.W. 15.
1921 Dover, C., *The Indian Museum, Calcutta, India.*
1913 ‡ Dow, Walter James, 5, *Great College-street, Westminster*, S.W. 1.
1910 Downes-Shaw, Rev. Archibald, *Scotton Rectory, Gainsborough.*
1884 ‡ Druce, Hamilton H. C. J., F.Z.S. (Council, 1903–5), 26, *South Hill Park, Hampstead*, N.W. 3.
1900 Drury, W. D., *Dorset House, St. Tobias-road, Sevenoaks.*
1894 Dudgeon, G. C., 1, *Zetland House, Cheniston-gardens, Kensington*, W. 8.
1913 Duffield, Charles Alban William, *Stowting Rectory, Hythe*, and *Wye College, Kent.*
1906 ‡ Dukinfield Jones, E., 118, *Fairview-avenue, Glendale, California, U.S.A.*
1883 ‡ Durrant, John Hartley (V.-Pres., 1912–13; Council, 1911–13, 1919–21), *Merton*, 17, *Burstock-road, Putney*, S.W. 15; and *British Museum (Natural History), Cromwell-road, S. Kensington*, S.W. 7.

1910 ‡ Eales-White, Capt. J. Cushny, 49, *Chester-terrace, Eaton-square*, S.W. 1.

1912 ‡ Earl, Herbert L., M.A., *Vanessa, Rawlyn-road, Torquay.*

1865 ‡ Eaton, The Rev. Alfred Edwin, M.A. (Council, 1877–9), *Richmond Villa, Northam S.O., N. Devon.*

1902 ‡ Edelsten, Hubert M., *Oakhurst, Balcombe-road, Haywards Heath, Sussex.*

1919 Edwardes, Capt. Tickner, R.A.M.C., *The Red Cottage, Burpham, Arundel, Sussex.*

1911 ‡ Edwards, F. W., 56, *Norton-road, Letchworth.*

1886 Edwards, James, *Colesborne, Cheltenham.*

1884 ‡ Edwards, Stanley, F.L.S., F.Z.S. (Council, 1912–14), 15, *St. Germans-place, Blackheath*, S.E. 3.

1913 Edwards, William H., *Natural History Dept., The Museum, Birmingham.*

1916 ‡ Effelatoun, Hassan, 38, *Shoubrah-avenue, Cairo, Egypt.*

1900 ‡ Elliott, E. A., 41, *Chapel Park-road, St. Leonards-on-Sea.*

1900 ‡ Ellis, H. Willoughby, F.Z.S. (Council, 1916–18), 3, *Lancaster-place, Belsize Park*, N.W. 3.

1919 Elston, Albert H., 69, *Lefevre Terrace, N. Adelaide, S. Australia.*

1903 ‡ Eltringham, Harry, M.A., D.Sc., F.Z.S. (Secretary, 1922– ; V.-Pres., 1914, 1918 ; Council, 1913–15, 1918–20), *Woodhouse, Stroud, Gloucestershire*, and *Hope Department, University Museum, Oxford.*

1878 Elwes, Henry John, J.P., F.R.S., F.L.S., F.Z.S. (Pres., 1893–4 ; V.-Pres., 1889–90, 1892, 1895 ; Council, 1888–90), *Colesborne, Cheltenham.*

1903 Etheridge, Robert, *Curator, Australian Museum, Sydney, N.S.W.*

1908 Eustace, Eustace Mallabone, M.A., *Wellington College, Berks.*

1919 Evans, Lt.-Col. Wm. Harry, D.S.O., R.E., c/o Messrs. Cox & Co., 16, *Charing Cross*, W.C. 2, and *H.Q. Northern Command, Murree, Punjab, India.*

1919 Falconer, William, *Wilberlee, Slaithwaite, Huddersfield.*

1907 Feather, Walter, *Cross Hills, nr. Keighley, Yorks.*

1900 ‡ Feltham, H. L. L., *Mercantile Buildings, Summonds-street, Johannesburg, Transvaal.*

1861 ‡ Fenn, Charles, *Eversden House, Burnt Ash Hill, Lee*, S.E. 12.

1920 Fenton, Edward Wyllie, M.A., B.Sc., *Seale-Hayne Agricultural College, Newton Abbot, Devon.*

1918 ‡ Ferguson, Anderson, 22, *Polwarth-gardens, Glasgow, W.*

1918 * Fernald, Prof. C. H., c/o H. T. Fernald, Esq., *Amherst, Mass., U.S.A.*

1900 Firth, J. Digby, F.L.S., *Boys' Modern School, Leeds.*

1898 ‡ Fletcher, Prof. T. Bainbrigge, R.N., *Agricultural Research Institute, Pusa, Bihar, India.*

1883 † Fletcher, William Holland B., M.A., *Aldwick Manor, Bognor.*

1905 Floersheim, Cecil, 16, *Kensington Court Mansions*, S.W. 8.
1885 Fokker, A. J. F., *Zierikzee, Zeeland, Netherlands.*
1914 Fordham, William John, M.R.C.S., L.R.C.P., D.Ph., 8, *Albert Drive, Low Fell, Gateshead.*
1913 Foster, Arthur H., M.R.C.S., L.R.C.P.(Eng.), M.B.O.U., *Sussex House, Hitchin, Herts.*, and 13, *Tilehouse-street, Hitchin, Herts.*
1900 Foulkes, P. Hedworth, B.Sc., *Harper-Adams Agricultural College, Newport, Salop.*
1898 ‡ Fountaine, Miss Margaret E., 126, *Lexham Gardens*, W. 8.
1880 ‡ Fowler, The Rev. Canon, D.Sc., M.A., F.L.S. (Pres., 1901–2; V.-Pres., 1903; Sec., 1886–96), *Earley Vicarage, near Reading.*
1921 Fox, C. L., 1621, *Vallejo Street, San Francisco, California, U.S.A.*
1920 ‡ Fox-Wilson, G., *Entomological Dept., R.H.S. Laboratory, Wisley, Ripley, Surrey.*
1908 Fraser, Frederick C., Capt., M.D., I.M.S., 309, *Brownhill-road, Catford, S.E.*
1888 ‡ Fremlin, H. Stuart, M.R.C.S., L.R.C.P., *White House Farm, Bedmond, by King's Langley, Herts.*
1921 Frew, J. G. H., 262, *Church-road, Yardley, Birmingham.*
1910 ‡ Frisby, G. E., 31, *Darnley-road, Gravesend.*
1908 Froggatt, Walter W., F.L.S., Government Entomologist, *Agricultural Museum, George-street North, Sydney, New South Wales.*
1891 Frohawk, F. W., *Uplands, Thundersby, Essex.*
1907 ‡ Fryer, John Claud Fortescue, M.A. (Council, 1916–18), *Milton-road, Harpenden, Herts.*
1876 ‡ Fuller, The Rev. Alfred, M.A., *The Lodge*, 7, *Sydenham-hill, Sydenham*, S.E. 26.

1887 ‡ Gahan, Charles Joseph, M.A., D.Sc. (Pres., 1917–18; V.-Pres., 1916, 1919; Sec., 1899–1900; Council, 1893–5, 1901, 1914–16, 1919), 8, *Lonsdale-road, Bedford Park*, W. 4; and *British Museum (Natural History), Cromwell-road*, S.W. 7.
1890 * Gardner, John, *Laurel Lodge, Hart, West Hartlepool.*
1920 Gardner, J. C. M., *Entomological Dept., Royal College of Science, S. Kensington*, S.W. 7.
1901 †‡ Gardner, Willoughby, F.L.S., F.S.A., *Deganwy, N. Wales.*
1920 Gauntlett, Harry Leon, F.Z.S., M.R.C.S., L.R.C.P., A.K.C., 45, *Hotham-road, Putney*, S.W. 15.
1913 ‡ de Gaye, J. A., *P.O. Box* 413, *Lagos, S. Nigeria.*
1919 ‡ Gedye, Alfred Francis John, *c/o Barclay's Bank, Leigh-on-Sea, Essex.*
1899 ‡ Geldart, William Martin, M.A., 10, *Chadlington-road, Oxford.*
1913 ‡ Gibb, Lachlan, 38, *Blackheath Park, Blackheath*, S.E. 3.
1915 Gibson, Arthur, *Entomological Branch, Dept. of Agriculture, Ottawa, Canada.*
1908 Giffard, Walter M., *P.O. Box* 308, *Honolulu, Hawaii.*
1895 Gilbert-Carter, Sir G. T., K.C.M.G., *Ilaro Court, Barbados.*

1907 Giles, Henry Murray, Head Keeper of Zoological Gardens, *South Perth, W. Australia.*

1904 ‡ Gilliat, Francis, B.A., *Windham Club, St. James's-square, Piccadilly,* S.W. 1.

1919 Gimingham, Conrad Theodore, O.B.E., F.I.C., *The Cottage, Offchurch,* nr. *Leamington Spa.*

1921 Glick, P. A., 903, *West Illinois, Urbana, Illinois, U.S.A.*

1914 ‡ Godfrey, E. J., Education Dept., *Bangkok, Siam.*

1920 ‡ Goodban, Bernard Sinclair, *Belmont, Anerley-road, Anerley,* S.E. 19.

1921 ‡ Goodman, O. R., 210, *Goswell-road,* E.C. 1.

1904 Goodwin, Edward, *Canon Court, Wateringbury, Kent.*

1898 ‡ Gordon, J. G. McH., *Corsemalzie, Whauphill S.O., Wigtownshire.*

1898 ‡ Gordon, R. S. G. McH., *Drumblair, Inverness.*

1913 Gough, Lewis, Ph.D., Entomologist to the Govt. of Egypt, *Dept. of Agriculture, Cairo.*

1909 Gowdey, Carlton C., B.Sc., *Hope, Kingston P.O., Jamaica.* Transactions to 116, *Pleasant-street, Amherst, Mass., U.S.A.*

1918 Grace, George, B.Sc., A.R.C.Sc., 23, *Alexander-crescent, Ilkley, Yorks.*

1914 Graveley, F. H., *The Indian Museum, Calcutta.*

1911 ‡ Graves, Major P. P., *Club de Constantinople, Constantinople.*

1891 †‡ Green, E. Ernest, F.Z.S. (V.-Pres., 1915; Council, 1914–16), *Way's End, Beech-avenue, Camberley.*

1894 Green, J. F., F.Z.S., *City of London Club, Old Broad-street,* E.C. 2.

1893 † Greenwood, Henry Powys, F.L.S., *Whitsbury House, Salisbury.*

1920 Griffin, J. W., 27, *The Summit, Liscard, Wallasey.*

1888 Griffiths, G. C., F.Z.S., *Penhurst,* 3, *Leigh-road, Clifton, Bristol.*

1894 ‡ Grimshaw, Percy H., *Royal Scottish Museum, Edinburgh.*

1905 Grist, Charles J., *The Croft, Carol Green, Berkswill, Coventry.*

1920 ‡ Grosvenor, T. H. L., *Walldeanes, Redhill, Surrey.*

1920 ‡ Gunton, Major H. C., *Seaton Cottage, Gerrard's Cross Common, Bucks.*

1906 Gurney, Gerard H., *Keswick Hall, Norwich.*

1910 Gurney, William B., Asst. Govt. Entomologist, *Department of Agriculture, Sydney, Australia.*

1912 Hacker, Henry, *Queensland Museum, Brisbane, Queensland.*

1919 Hadwen, Dr. Seymour, D.Vet.Sci., *Biological Central Experimental Farm, Ottawa, Canada.*

1906 ‡ Hall, Arthur, 7, *Park-lane-mansions, Croydon.*

1890 †‡ Hall, Albert Ernest, c/o *City Librarian, Surrey-street, Sheffield.*

1885 ‡ Hall, Thomas William, *Wood Grange, Shire-lane, Chorley Wood, Herts.*

1921 Hall, W. J., Entomologist, *Ministry of Agriculture, Cairo, Egypt.*

1912 Hallett, Howard Mountjoy, 64, *Westbourne-road, Penarth, Glamorganshire.*

1915 Hamm, Albert Harry, 22, *Southfield-road, Oxford.*
1891 ‡ Hanbury, Frederick J., F.L.S., *Brockhurst, E. Grinstead.*
1905 † Hancock, Joseph L., 5454, *University-avenue, Chicago, U.S.A.*
1917 Harding, William G., F.L.S., M.R.S.L., F.R.H.S., *St. George's School, Windsor.*
1920 Hardy, Alister Clavering, 40, *Harlow Moor-drive, Harrogate.*
1903 ‡ Hare, E. J., 4, *New-square, Lincoln's Inn,* W.C. 2.
1920 ‡ Hargreaves, Ernest, *Entomological Section, Ministry of Agriculture, Cairo, Egypt.*
1920 Hargreaves, Harry, *Biological Laboratory, Kampala, Uganda.*
1921 Harland, S. C., D.Sc., *Shirley Institute, Didsbury, near Manchester.*
1910 ‡ Harwood, Philip Bernard, 2, *Westbury Terrace, Westerham, Kent.*
1919 ‡ Hawker-Smith, William, *Speedwell Cottage, Hambledon, Godalming, Surrey.*
1910 * Hawkshaw, J. C.
1913†‡Hawkshaw, Oliver, 3, *Hill-street, Mayfair,* W. 1.
1919 ‡ Hayward, H. C., M.A., *Repton, Derby.*
1921 Hayward, K. J., *Reservoir, Aswân, Upper Egypt.*
1910 ‡ van der Hedges, Alfred, *Mayneshill, Hoggeston, Winslow, Bucks.*
1919 ‡ Hemming, Arthur Francis, 9, *Victoria-grove,* W. 8, and *Treasury Chambers, Whitehall,* S.W. 1.
1910 Henderson, J., c/o Messrs. Osborne & Chappel, *Ipoh, Perak, Federated Malay States.*
1918 Herrod-Hempsall, Joseph, *Orchard House, Stockingstone-road, Luton, Beds.*
1903 Herrod-Hempsall, William, *W.B.C. Apiary, Old Bedford-road, Luton, Beds.*
1913 Hewitt, John, B.A., Director, *Albany Museum, Grahamstown, S. Africa.*
1876*‡Hillman, Thomas Stanton, *Eastgate-street, Lewes.*
1907 ‡ Hoar, Thomas Frank Partridge, *Mercia, Albany-road, Leighton Buzzard.*
1917 Hockin, John W., *Castle-street, Launceston.*
1920 Hodge, Albert Ernest, F.Z.S., 14, *Astonville-street, Southfields,* S.W.18.
1914 Hodge, The Rev. Canon Edward Grose, *The Rectory, Birmingham.*
1912 Hodge, Harold, 91, *Highbury-place,* N. 5.
1888 Hodson, The Rev. J. H., B.A., B.D., *Rhyddington, Clifton Drive, Lytham.*
1902 Hole, R. S., c/o Messrs. King and Co., *Bombay.*
1910 Holford, H. O., *Elstead Lodge, Godalming, Surrey.*
1887 Holland, The Rev. W. J., D.D., Ph.D., *Carnegie Museum, Pittsburgh, Penn., U.S.A.*
1898 Holman-Hunt, C. B., F.Z.S., Systematic Entomologist, Department of Agriculture, *Kuala Lumpur, Federated Malay States.*
1910 ‡ Holmes, Edward Morrell, *Ruthven, Sevenoaks.*
1921 Hope, H. Donald, 76, *Jermyn-street,* S.W. 1.
1921 Hopper, L. B., *Manor House, Penryn, Cornwall.*

1901 ‡ Hopson, Montagu F., L.D.S., R.C.S.Eng., F.L.S., 7, *Harley-street*, W. 1.
1897 Horne, Arthur, *Bonn-na-coile, Murtle, Aberdeenshire.*
1919 de Horrack-Fournier, Mme., 90, *Boulevard Malesherbes, Paris,* and *Château de Voisins, Louveciennes, Seine et Oise, France.*
1907 † Howard, C. W., *Canton Christian College, Canton, China.*
1900 Howes, W. George, 259, *Cumberland-street, Dunedin, New Zealand.*
1888 Hudson, George Vernon, *Hill View, Karori, Wellington, New Zealand.*
1907 Hughes, C. N., 178, *Clarence Gate-gardens, Regent's Park*, N.W. 1.
1917 Hunter, David, M.A., M.B., *The Coppice, Nottingham.*

1897 ‡ Image, Prof. Selwyn, M.A. (Council, 1909–11), 78, *Parkhurst-road, Camden-road*, N. 7.
1912†‡Imms, A. D., D.Sc., M.A., F.L.S. (Vice-President, 1920 ; Council, 1919–21), *Rothamsted Experimental Station, Harpenden, Herts.*
1920 Inglis, Charles McFarlane, F.Z.S., M.B.O.U., *Baghouaie Factory, Laheria Sarai, Bihar, India.*
1918 Isaacs, P. V., 2, *Gledhill-terrace, South Kensington*, S.W. 5.

1907 Jack, Rupert Wellstood, Government Entomologist, Department of Agriculture, *Salisbury, Rhodesia.*
1917 ‡ Jackson, Miss Dorothy J., *Swordale, Evanton, Ross-shire.*
1907 ‡ Jackson, P. H., *Ellesmere, The Drive, Sevenoaks.*
1911 ‡ Jacobs, Major J. J., R.E., *Holmesleigh, Burgess Hill, Sussex.*
1920 James, Russell, 7, *Broadlands-road, Highgate*, N. 6.
1914 ‡ Janse, A. J. T., 1*st-street, Gezina, Pretoria, S. Africa.*
1869 ‡ Janson, Oliver E., 44, *Great Russell-street, Bloomsbury*, W.C. 1 ; and *Cestria, Claremont-road, Highgate*, N. 6.
1898 Janson, Oliver J., 13, *Fairfax-road, Hornsey, N.*
1919 ‡ Jeans, Miss Gertrude M., *Penn Court*, 54, *Cromwell-road*, S.W. 7.
1886 Jenner, James Herbert Augustus, *East Gate House, Lewes.*
1909 Jepson, Frank P., *Peradeniya, Ceylon.*
1917 ‡ Jermyn, Col. Turenne, *Highcliffe, Weston-super-Mare.*
1886 John, Evan, *Llantrisant S.O., Glamorganshire.*
1907 Johnson, Charles Fielding, *West Bank, Didsbury-road, Heaton Mersey.*
1917 Johnson, Jesse, *Finca las Marias, Barberena, Guatemala.*
1889 Johnson, The Rev. W. F., M.A., *Killincoole Rectory, Castlebellingham, Co. Louth.*
1920 ‡ Johnstone, Douglas, *Brooklands, Rayleigh, Essex.*
1908 ‡ Joicey, James J., F.L.S., F.Z.S., F.R.G.S., etc. (Council, 1921–), *The Hill, Witley, Surrey.*
1888 ‡ Jones, Albert H. (V.-Pres., 1912, 1918; Treas.,1904-17 ; Council, 1898–1900, 1918), *Shrublands, Eltham*, S.E. 9.
1920 ‡ Jones, Rev. Neville, *Hope Fountain, Box* 283, *Bulawayo, Rhodesia, S. Africa.*

1894††Jordan, Dr. K., F.R.S. (V.-Pres., 1909; Council, 1909–11), *The Museum, Tring.*
1910 ‡ Joseph, E. G., 23, *Clanricarde-gardens*, W. 2.
1910 ‡ Joy, Ernest Cooper, *Eversley, Dale-road, Purley.*
1902 ‡ Joy, Norman H., M.R.C.S., L.R.C.P., *Theale, Berks.*
1919 Jurriaanse, J. H., *W.Z. Schickade*, 75, *Rotterdam, Holland.*

1911 Kannan, Kunhi, M.A., Asst. Entomologist to the Govt. of Mysore, *Bangalore, South India.*
1896††Kaye, William James (Council, 1906–8), *Caracas, Ditton Hill, Surbiton.*
1890 ‡ Kenrick, Sir George H., *Whetstone, Somerset-road, Edgbaston, Birmingham.*
1920 Kent-Lemon, Capt. Arthur Leslie, York & Lancaster Regt., *c/o Postmaster, Khartoum, Sudan*, and *Blytheswood, Ascot, Berks.*
1904 Kershaw, G. Bertram, *Ingleside, West Wickham, Kent.*
1906 Keynes, John Neville, M.A., D.Sc., 6, *Harvey-road, Cambridge.*
1900 Keys, James H., 7, *Whimple-street, Plymouth.*
1919 Khare, Jagamath Laxman, Lecturer in Entomology, *Agricultural College, Nagpur, India.*
1912 ‡ King, Harold H., Govt. Entomologist, *Gordon College, Khartoum, Sudan.*
1889 ‡ King, James J. F.-X., 1, *Athole Gardens-terrace, Kelvinside, Glasgow.*
1913 Kirby, W. Egmont, M.D., *Hilden*, 46, *Sutton Court-road, Chiswick*, W.4.
1917 ‡ Kirkpatrick, Thos. W., *The Deanery, Ely*, and *Room* 270, *War Office, Whitehall*, S.W. 1.
1887 † Klein, Sydney T., F.L.S., F.R.A.S., *Lancaster Lodge, Kew Gardens, Surrey.*
1920 Knight, V., Assistant Director, *Raffles Museum, Singapore.*

1916 ‡ Laing, Frederick (Council, 1922–), *Natural History Museum, Cromwell-road*, S.W. 7.
1910 ‡ Lakin, C. Ernest, M.D., F.R.C.S., 105, *Harley-street*, W. 1.
1911††Lamborn, W. A., M.R.C.S., L.R.C.P., *Littlemore, nr. Oxford.*
1921 ‡ Lancum, F. H., *Fernside, Shepherd's Lane, Dartford, Kent.*
1917 Langham, Sir Charles, Bart., *Tempo Manor, Co. Fermanagh.*
1920 Lathy, Percy I., 90, *Boulevard Malesherbes*, and 70, *Boulevard August Blaqui, Paris.*
1916 Latta, Prof. Robert, D.Phil., *University of Glasgow.*
1895 Latter, Oswald H., M.A., *Charterhouse, Godalming.*
1899 Lea, Arthur M., Government Entomologist, *Museum, Adelaide, S. Australia.*
1914 Leechman, Alleyne, M.A., F.L.S., F.C.S., *Amani*, near *Tanga, Tanganyika Territory, East Africa.*
1910 Leigh, H. S., *The University, Manchester.*
1900 Leigh-Phillips, Rev. W. J., *Burtle Vicarage, Bridgwater.*

1920 ‡ LEMAN, George Beddome Curtis, *Wynyard*, 52, *West Hill*, *Putney Heath*, S.W. 15.

1920 ‡ LEMAN, George Curtis, *Wynyard*, 52, *West Hill*, *Putney Heath*, S.W. 15.

1920 ‡ LEMAN, Sydney Curtis, *Wynyard*, 52, *West Hill*, *Putney Heath*, S.W. 15.

1903†‡LEVETT, The Rev. Thomas Prinsep, *Frenchgate*, *Richmond*, *Yorks.*

1876 ‡ LEWIS, George, F.L.S. (COUNCIL, 1878, 1884), 30, *Shornclife-road*, *Folkestone.*

1908 † LEWIS, John Spedan, *High Combe*, *Balcombe*, *Surrey;* and 277, *Oxford-street*, W. 1.

1892 LIGHTFOOT, R. M., *South African Museum*, *Cape Town*, *Cape of Good Hope.*

1914 ‡ LISTER, J. J., *St. John's College*, *Cambridge;* and *Merton House*, *Grantchester*, *Cambs.*

1903 LITTLER, Frank M., *Box* 114, *P.O.*, *Launceston*, *Tasmania.*

1865 † LLEWELYN, Sir John Talbot Dillwyn, Bart., M.A., F.L.S., *Penllergare*, *Swansea.*

1881 † LLOYD, Alfred, F.C.S., *The Dome*, *Bognor.*

1919 ‡ LLOYD, Llewellyn, D.Sc., *Slingsby*, *Malton*, *Yorks.*

1885†‡LLOYD, Robert Wylie (COUNCIL, 1900–1), I, 5 and 6, *Albany*, *Piccadilly*, W. 1.

1920 ‡ LODGE, George, *Hawkhouse*, *Camberley.*

1903 LOFTHOUSE, Thomas Ashton, *The Croft*, *Linthorpe*, *Middlesbrough.*

1908 ‡ LONGSDON, D., *The Flower House*, *Southend*, *Catford*, S.E. 6.

1904*†‡LONGSTAFF, George Blundell, M.A., M.D. (V.-PRES., 1909, 1915, 1917; COUNCIL, 1907–9, 1915-17), *Highlands*, *Putney Heath*, S.W. 15.

1920 LOVERIDGE, Arthur, *c/o Game Dept.*, *Dar-es-Salaam*, *E. Africa.*

1893 LOWER, Oswald B., *Pinarro*, *South Australia.*

1901 LOWER, Rupert S., *Tranmere*, *Magill-road*, *Canyton*, *S. Australia.*

1921 ‡ LOWES, E. D., *Home for Orphans*, *Swanley*, *Kent.*

1898 ‡ LUCAS, William John, B.A. (COUNCIL, 1904–6), 28, *Knight's Park*, *Kingston-on-Thames.*

1903 LYELL, G., *Gisborne*, *Victoria*, *Australia.*

1912 ‡ LYLE, George Trevor, *Sunthorpe*, *St. George's-road*, *Wallington*, *Surrey.*

1909 LYON, Francis Hamilton, *Silversundsvagen* 29, *Helsingfors-Brande*, *Finland.*

1910 MACDOUGALL, Professor R. Stewart, M.A., D.Sc., F.R.S.E., 9, *Dryden Place*, *Blacket Avenue*, *Edinburgh.*

1919 MCLEOD, Murdoch Campbell, *The Fairfields*, *Cobham*, *Surrey*, and c/o McLeod & Son, *Calcutta*, *India.*

1900 MACKWOOD, The Hon. F. M., M.L.C., *Colombo*, *Ceylon.*

1899†‡MAIN, Hugh, B.Sc. (COUNCIL, 1908-10), *Almondale*, *Buckingham-road*, *South Woodford*, N.E.

1905 Mally, Charles William., M.Sc., *Dept. of Agriculture, Cape Town, S. Africa.*
1892 ‡ Mansbridge, William, *Dunraven, Church-road, Wavertree, Liverpool.*
1919 Mansfield-Aders, Dr. W., *Zanzibar.*
1920 Marriner, Thomas Frederic, 2, *Brunswick-street, Carlisle.*
1894†‡Marshall, Alick.
1895 ‡ Marshall, Guy Anstruther Knox, C.M.G., D.Sc., F.Z.S. (V.-Pres., 1919; Council, 1907–8, 1919–21), 6, *Chester-place, Hyde Park-square*, W. 2.
1896 Marshall, P., M.A., B.Sc., F.G.S., *University School of Mines, Dunedin, New Zealand.*
1897 Martineau, Alfred H., *Barum, Crewkerne, Somerset.*
1919 Marumo, N., *Zoological Institute, Agricultural College, Imperial University, Komaba, Tokyo, Japan.*
1895 Massey, Herbert, *Ivy-Lea, Burnage, Didsbury, Manchester.*
1865 Mathew, Gervase F., F.L.S., Paymaster-in-chief, R.N. (Council, 1887), *Lee House, Dovercourt, Harwich.*
1921 Matsumura, Prof. S., *Hokkaido Imperial University, Sapporo, Japan.*
1887 Matthews, Coryndon, *Woodside, Salcombe, S. Devon.*
1912 Maulik, Prof. S., *Dept. of Zoology, University of Calcutta, Calcutta, India.*
1900 ‡ Maxwell-Lefroy, Professor H., *Imperial College of Science and Technology, South Kensington*, S.W.
1916 ‡ May, Harry Haden, *Kapai, Elburton, S. Devon.*
1913 ‡ Meaden, Louis, *Melbourne, Dyke-road, Preston, Brighton.*
1920 ‡ Meldola, Mrs. Ella Frederica, 6, *Brunswick-square*, W.C. 1.
1919 Mellows, Charles, M.A., *The College, Bishop's Stortford.*
1885 Melvill, James Cosmo, M.A., F.L.S., *Meole Brace Hall, Shrewsbury.*
1907*‡Melville, Mrs. Catharine Maria, *Kapai, Elburton, S. Devon.*
1887 ‡ Merrifield Frederic (Pres., 1905–6; V.-Pres., 1893, 1907; Sec., 1897–8; Council, 1894, 1899), 14, *Clifton-terrace, Brighton.*
1912 Metcalfe, Rev. J. W., *St. Luke's House, Torquay.*
1880 ‡ Meyrick, Edward, B.A., F.R.S., F.Z.S., *Thornhanger, Marlborough.*
1919 Miles, Herbert William, N.D.A., *The Gardens, Sydney Park, Gloucester.*
1883 ‡ Miles, W. H., c/o E. Step, Esq., 158, *Dora-road, Wimbledon Park*, S.W. 19.
1920 Miller, D., 71, *Fairlie Terrace, Kelburn, Wellington, New Zealand.*
1905 ‡ Mitford, Robert Sidney, C.B., 9, *Beaconsfield-terrace, Hythe, Kent.*
1902 ‡ Montgomery, Arthur Meadows, 34, *Shalimar Gardens, Acton*, W. 3.
1899 ‡ Moore, Harry, 12, *Lower-road, Rotherhithe*, S.E. 16.
1916 Moore, Ralph Headley, B.A., *Heathfield, Plymstock, Devon.*
1886 Morgan, A. C. F., F.L.S., 135, *Oakwood-court, Kensington*, W. 14.

1889†‡Morice, The Rev. F. D., M.A., F.Z.S., Fellow of Queen's College, Oxford (Pres., 1911–12; V.-Pres., 1902, 1904, 1913, 1919; Council, 1902–4, 1918–20), *Brunswick, Mount Hermon, Woking.*

1895†‡Morley, Claude, F.Z.S., *Monk Soham House, Suffolk.*

1920 Morris, Hubert Meridydd, M.Sc., *Institute of Plant Pathology, Rothamsted Experimental Station, Harpenden, Herts.*

1893 Morton, Kenneth J., 13, *Blackford-road, Edinburgh.*

1910 ‡ Mosely, Martin E., 94, *Campden Hill-road, Kensington*, W. 8.

1882 Mosley, S. L., *Ravensknowle Museum, Huddersfield.*

1911 ‡ Moss, Rev. A. Miles, c/o Messrs. Booth & Co., *Para, Brazil.*

1907†‡Moulton, John C., O.B.E., M.A., B.Sc., F.Z.S., &c., Director, *Raffles Museum and Library, Singapore, Straits Settlements*, and *The Hall, Bradford-on-Avon.*

1911 Mounsey, J. Jackson, 24, *Glencairn-crescent, Edinburgh.*

1901†‡Muir, Frederick, *H.S.P.A. Experiment Station, Honolulu, Oahu, H.I.*

1912 † Mullan, Jal Phirozshah, M.A., F.L.S., F.Z.S., Professor of Biology, *St. Xavier's College, Lamington-road, Grant Road Post, Bombay, India.*

1869*†‡Muller, Albert, F.R.G.S. (Council, 1872–3), c/o Herr A. Muller-Mechel, *Grenzaeherstrasse* 60, *Basle, Switzerland.*

1920 Munro, Hugh Kenneth, B.Sc., 258, *Bourke-street, Pretoria, S. Africa.*

1918 Munro, James W., M.D., R.A.M.C., *Green Lawn, Kew-road, Richmond, Surrey.*

1914 Murray, George H., *The Residency, Kerema Gulf Division, Papua.*

1917 Muschamp, Percy A. H., 35, *Upperton-road, Leicester.*

1909 Musham, John F., 48, *Brook-street, Selby, Yorks.*

1920 Myers, J. G., *Aramoho, Wanganui, New Zealand.*

1903 ‡ Neave, S. A., M.A., D.Sc., F.Z.S. (Secretary, 1919– ; V.-Pres., 1918; Council, 1916–18), 41, *Queen's Gate*, S.W. 7, and *Bishop's House, Beaconsfield, Bucks.*

1919 ‡ Nell, Louis, *Imperial Bureau of Entomology*, 41, *Queen's Gate*, S.W. 7.

1919 Nelson, William George Frazer (Council, 1922–), 6, *Bolton Street, Piccadilly*, W. 1.

1901 ‡ Nevinson, E. B., *Morland, Cobham, Surrey.*

1907 ‡ Newman, Leonard Woods, *Bexley, Kent.*

1913 Newman, Leslie John William, *Bernard-street, Claremont, W. Australia.*

1909 Newstead, Alfred, *The Grosvenor Museum, Chester.*

1890 ‡ Newstead, Prof. Robert, M.Sc., F.R.S., A.L.S., Hon. F.R.H.S., Dutton Memorial Professor of Entomology, *The School of Tropical Medicine, University of Liverpool.*

1914 ‡ Nicholson, Charles, 35, *The Avenue, Hale-end, Chingford*, E. 4.

1909 ‡ Nicholson, Gilbert W., M.A., M.D. (Council, 1913–15), *Oxford and Cambridge Club, Pall Mall*, S.W. 1.

1918 ‡ Nimmy, Ernest William, 210, *Whippendell-road, Watford, Herts.*
1906 Nix, John Ashburner, *Tilgate, Crawley, Sussex.*
1914 Norris, Frederic de la Mare, *The Agricultural Department, Kuala Lumpur, Federated Malay States.*
1915 Northcote, Dr. A. B., 4, *Columbia-road, Bethnal Green,* E. 2.
1895 Nurse, Lt.-Colonel C. G., *Redcote, Rusthall Park, Tunbridge Wells.*

1877 Oberthür, René, *Rennes (Ille-et-Vilaine), France.*
1910 ‡ Oldaker, Francis A., M.A., *The Red House, Haslemere.*
1921 Ollenbach, O. C., *Survey of India Dept., Dehra Dun, India.*
1918 O'Neil, Rev. Fr., S.J., *P.O. Box 54, Salisbury, Rhodesia, S. Africa.*
1913 ‡ Ormiston, Walter, *Holly Lodge, St. Margarets-on-Thames.*

1895 ‡ Page, Herbert E. (Council, 1918–20), *Bertrose, Gellatly-road, St. Catherine's Park,* S.E. 15.
1921 Pallis, M. A., *Tatoi, Aigburth Drive, Liverpool.*
1916 Palmer, Arthur Raymond, *Inglcholme, Norton Way, Letchworth, Herts.*
1919 Paravicini, Louis, *Commissioner de la Bourse de Bâle, Bâle, Switzerland.*
1918 ‡ Parris, R. Stanway, *Beachleigh, Kingsgate, Broadstairs.*
1919 Patton, Major W. J., I.M.S., 34, *York-road, Trinity, Edinburgh.*
1911 ‡ Pearson, Douglas, *Chilwell House, Chilwell, Notts.*
1916 ‡ Peebles, Howard M., 13, *Chesham-street,* S.W. 1.
1919 Peed, John, *Aylsham, Norfolk.*
1915 ‡ Peile, Lt.-Col. Harry Diamond, I.M.S., c/o H. S. King & Co., 9, *Pall Mall,* S.W. 1. [Transactions to H. F. G. Watkins, 38, *Denbigh-road, West Ealing,* W. 13.]
1921 ‡ Pendlebury, H. M., *Broadlands, Shrewsbury;* Systematic Entomologist, *Federated Malay States.*
1914 ‡ Pendlebury, Major Wm. J. von Monté, *Broadlands, Shrewsbury,* and *Keble College, Oxford.*
1883 Péringuey, Louis, D.Sc., F.Z.S., Director, *South African Museum, Cape Town, South Africa.*
1903 † Perkins, R. C. L., M.A., D.Sc., F.Z.S., *Park Hill House, Paignton, Devon;* and Board of Agriculture, Division of Entomology, *Honolulu, Hawaii.*
1907 † Perrins, J. A. D., 3rd Seaforth Highlanders, *Davenham, Malvern.*
1897 ‡ Phillips, Capt. Hubert C., M.R.C.S., L.S.A., 17, *Hereford-road, Bayswater,* W. 2.
1903 †‡ Phillips, Montagu A., F.R.G.S., F.Z.S., *Devonshire House Preparatory School, Reigate.*
1920 Philpott, A., Assistant Entomologist, Biological Dept., *Cawthron Institute of Scientific Research, Nelson, New Zealand.*
1917 ‡ Pickard-Cambridge, Arthur D., M.A., *Balliol College, Oxford.*
1891 ‡ Pierce, Frank Nelson, *The Old Rectory, Warmington, Oundle, Northants.*

1913 Platt, Ernest Edward, 403, *Essenwood-road, Durban, Natal.*

1885 Poll, J. R. H. Neerwort van der, *c/o* J. Stroeve, *B.Z. Prinsengracht*, 1005, *Amsterdam.*

1919 Pomeroy, Arthur W. Jobbins, Government Entomologist in Nigeria, *Ibadan, S. Nigeria.*

1870†‡Porritt, Geo. T., F.L.S. (Council, 1887), *Elm Lea, Dalton, Huddersfield.*

1884†‡Poulton, Professor Edward B., D.Sc., M.A., F.R.S., F.L.S., F.G.S., F.Z.S., Hope Professor of Zoology in the University of Oxford (Pres., 1903–4; V.-Pres., 1894–5, 1902, 1905; Council, 1886–8, 1892, 1896, 1905–7, 1922–), *Wykeham House, Banbury-road, Oxford.*

1905 Powell, Harold, 7, *Rue Mireille, Hyères (Var), France.*

1921 Powniah, D., *Agricultural Dept., Kuala Lumpur, Federated Malay States.*

1919 Praed, Cyril Winthrop Mackworth, *Dalton Hill, Albury, Surrey.*

1908 ‡ Pratt, William B., 10, *Lion Gate Gardens, Richmond, Surrey.*

1878 Price, David, 48, *West-street, Horsham.*

1908 ‡ Prideaux, Robert M. (Council, 1917), *Woodlands, Brasted Chart, Sevenoaks.*

1920 ‡ Prior, W. H. T., *Culban, Main-road, New Eltham, Kent.*

1904 ‡ Priske, Richard A. R., 9, *Melbourne Avenue, West Ealing.*

1920 Prout, Miss Alice Ellen, *Lane End, Hambledon, Surrey.*

1893 ‡ Prout, Louis Beethoven (Council, 1905–7), 84, *Albert-road, Dalston*, E. 8.

1910 Punnett, Professor Reginald Crundall, M.A., *Caius College, Cambridge.*

1912 ‡ Rait-Smith, W., *Birkby House, Bickley Park, Kent.*

1914 Ramakrishna Ayyar, T. V., B.A., F.Z.S., *The Agricultural College, Coimbatore, S. India.*

1920 ‡ Rambousek, Dr. F. G., M.P., vii/1169, *Prague, Czechoslovakia.*

1913 Rao, K. Ananthaswamy, *Curator of the Government Museum, Bangalore, India.*

1916 Rao, Yelseti Ramachandra, M.A., *Agricultural College, Coimbatore, India.*

1920 Raymundo, Prof. Benedicto, Director of the Agricultural Society's Museum, 76, *rua Senador Alencar, Rio di Janeiro, Brazil.*

1907 ‡ Rayward, Arthur Leslie, *Durdells, Kinson, Dorset.*

1898 Reuter, Professor Enzio, *Helsingfors, Finland.*

1910 ‡ de Rhé-Philipe, G. W. V., Chief Examiner of Accounts, North-Western Rwy., *Abbott-road, Lahore, India.*

1921 Rhodes, F., *Corporation Art Gallery and Museum, Cartwright Memorial Hall, Lister Park, Bradford.*

1920 ‡ Rhynehart, John George, A.R.C.Sc.I., N.D.A., *Seeds and Plants Disease Division, Royal College of Science, Upper Merrion-street, Dublin.*

1920 ‡ Richards, Philip Bernard, 7, *Churchways-crescent, Horfield, Bristol.*
1920 ‡ Richardson, Arthur Walter, 28, *Avenue-road, Southall, Middlesex.*
1921 Riddell, Miss J., Y.W.C.A., 251, *So. Hill-street, Los Angeles, California, U.S.A.*
1912 ‡ Riley, Capt. Norman Denbigh (Council, 1921–), 5, *Brook Gardens, Beverley-road, Barnes,* S.W. 13, and *British Museum (Natural History), S. Kensington,* S.W. 7.
1908 ‡ Rippon, Claude, M.A., 28, *Springfield House, Abingdon.*
1917 Roberts, A. W. Rymer, M.A., *Zoological Laboratory, The Museum, Cambridge.*
1905 Robinson, Herbert C., *Curator of State Museum, Kuala Lumpur, Selangor.*
1904 ‡ Robinson, Lady, *Worksop Manor, Notts.*
1869*† Robinson Douglas, William Douglas, M.A., F.L.S., F.R.G.S., *Orchardton, Castle Douglas.*
1921 Roebuck, A., *Edgmond, Newport, Salop.*
1908 ‡ Rogers, The Rev. K. St. Aubyn, M.A., *Hartley Dale, Ringmore, S. Devon.*
1907 ‡ Rosenberg, W. F. H., 57, *Haverstock-hill,* N.W. 3.
1868 ‡ Rothney, George Alexander James, *Pembury, Tudor-road, Upper Norwood,* S.E.
1888†‡ Rothschild, The Right Hon. Lord, D.Sc., F.R.S., F.L.S., F.Z.S., President (Vice-President, 1920; Council, 1900, 1919), *Zoological Museum, Tring.*
1894†‡ Rothschild, The Hon. Nathaniel Charles, M.A., F.L.S., F.Z.S. (Pres., 1915–16; V.-Pres., 1914, 1917; Council, 1904, 1913–17), *Arundel-house, Kensington Palace Gardens,* W. 8.
1890 ‡ Routledge, G. B., *Tarn Lodge, Heads Nook, Carlisle.*
1887 ‡ Rowland-Brown, Henry, M.A. (V.-Pres. 1908, 1910; Sec., 1900-10, 1921; Council, 1914–16, 1922–), *Oxhey-grove, Harrow Weald.*
1892 ‡ Russell, S. G. C., *Roedean, The Avenue, Andover.*

1919 ‡ St. Aubyn, Capt. John G., c/o Sir Charles McGrigor & Co., 39, *Panton-street, Haymarket,* S.W. 1.
1906 Sampson, Colonel F. Winn, 115, *Tannsfield-road, Sydenham.*
1910 ‡ Saunders, H. A., *St. Ann's, Reigate.*
1920 Scharff, J. W., *Tampin, Federated Malay States.*
1901 Schaus, W., F.Z.S., *U.S. National Museum, Washington, D.C., U.S.A.,* 1737, *High-street, Washington, D.C.*
1920 Schlupp, W. F., B.Sc., *The School of Agriculture & Experimental Station, Potchefstroom, Transvaal.*
1907 ‡ Schmassmann, W., *Beulah Lodge, London-road, Enfield,* N.
1912 Schunck, Charles A., *Ewelme, Wallingford.*
1911 ‡ Scorer, Alfred George, *Hill Crest, Chilworth, Guildford.*
1909 ‡ Scott, Hugh, M.A., D.Sc., Curator in Entomology, *University Museum of Zoology, Cambridge.*
1920 ‡ Seabrook, Lieut. J., 8, *Warwick-place West, Belgravia,* S.W. 1.

1911 Selous, Cuthbert F., M.D., M.R.C.S., L.R.C.P., 25, *Church-road, Tunbridge Wells.*

1911†‡Sennett, Noel Stanton, 24, *de Vere-gardens, Kensington*, W. 8.

1915 Shaw, Dr. A. Eland, c/o R. Kelly, Esq., Solicitor, 59, *Swanston-street, Melbourne, Victoria, Australia.*

1886 Shaw, George T. (Librarian of the Liverpool Free Public Library), *William Brown-street, Liverpool.*

1905 ‡ Sheldon, W. George, F.Z.S. (Treasurer, 1918– ; Vice-President, 1920), *Youlgreave, South Croydon.*

1900†‡Shepheard-Walwyn, H. W., M.A., *Dalwhinnie, Kenley, Surrey.*

1921 Shroff, K. D., *Kelapith*, 22, *Oxford Road, Putney, S.W.*

1887†‡Sich, Alfred (Council, 1910–12), *Corney House, Chiswick*, W. 4.

1911 ‡ Simes, James A., *Greenacres, Woodside-road, Woodford Green, Essex.*

1904 ‡ Simmonds, Hubert W., *Sussex View, Cumberland-gardens, Tunbridge Wells.*

1921 ‡ Simms, H. M., B.Sc., *The Farlands, Stourbridge.*

1920 ‡ Skaife, George Harold, M.A., *Agricultural Dept., Cape Town, S. Africa.*

1902*‡Sladen, Frederick William Lambart, 44, *Gwynne-avenue, Ottawa, Canada.*

1902 ‡ Sloper, Gerard Orby, F.Z.S., J.P., *Badminton Club, Piccadilly*, W. 1.

1907 ‡ Sly, Harold Baker, *Kingston, Homestead-road, Edenbridge, Kent.*

1906 ‡ Smallman, Raleigh S., *Eliot Lodge, Albemarle-road, Beckenham, Kent.*

1916 Smart, Major H. Douglas, M.D., B.S., *Shelley, Huddersfield.*

1920 ‡ Smee, C., 6, *Wildwood-road, Golders Green*, N.W. 4.

1915 ‡ Smith, Adam Charles, *Horton, Mornington-road, Woodford Green.*

1901 Smith, Arthur, *County Museum, Lincoln.*

1911 ‡ Smith, B. H., B.A., *Frant Court, Frant, Tunbridge Wells.*

1918 Smith, Patrick Aubrey Hugh, *Sconner House, St. German's, Cornwall*, and 28, *Bruton-street, Berkeley-square*, W.

1912 ‡ Smith, Roland T., 131, *Queen's-road, Wimbledon*, S.W. 19.

1919 Smith, S. Gordon, F.L.S., *Estyn, Boughton, Cheshire.*

1918 † Smith, William Proctor, F.Z.S., *Haddon House, Ashton-on-Mersey.*

1885 ‡ South, Richard (Council, 1890–1), 4, *Mapesbury-court, Shoot-up Hill, Brondesbury*, N.W. 2.

1916 ‡ Sowerby, F. W., *Sea View, Little Haven, Pembrokeshire.*

1920 Spencer, John William, 5, *Dogford-road, Rayton, Oldham, Lancashire.*

1908 ‡ Speyer, Edward R., *Ridgehurst, Shenley, Herts.*

1919 ‡ Staniland, L. N., *Trewint, Coppett's-road, Muswell Hill*, N. 10.

1910 Stanley, The Rev. Hubert George, *Marshfield Vicarage, Cardiff.*

1919 Stansfield, Capt. Leslie Rawdon, R.G.A., c/o *Army and Navy Club, Pall Mall*, S.W. 1.

1910 ‡ Stentone, Rupert, *Ministry of Agriculture, Milton-road, Harpenden, Herts.*
1920 Stidstone, Engineer-Commander S. T., R.N., *H.M.S. Douglas, South Queensferry.*
1918 ‡ Stiff, Rev. Alfred T., *All Souls' Vicarage, Brighton.*
1910 ‡ Stoneham, Hugh Frederick, Capt. 1st Batt. E. Surrey Regt., *Stoneleigh, Reigate.*
1913 Storey, Gilbert, *Dept. of Agriculture, Cairo, Egypt.*
1915 ‡ Stott, Charles Ernest, *Eaton, London-road, Reigate.*
1896 ‡ Strickland, T. A. Gerald, *Southcott, Poulton, Fairford.*
1919 Susainathan, P., Assistant in Entomology, *College of Agriculture and Research Institute, Coimbatore, S. India.*
1884 Swinhoe, Colonel Charles, M.A., F.L.S., F.Z.S. (V.-Pres., 1894; Council, 1891–3; 1902–4), 4, *Gunterstone-road, West Kensington*, W. 14.
1894*‡ Swinhoe, Ernest, 4, *Gunterstone-road, West Kensington*, W. 14.
1876 ‡ Swinton, A. H., *Oak Villa, Braishfield, Romsey, Hants.*
1911 ‡ Swynnerton, C. F. M., *Killossa, Tanganyika Territory.*
1920 ‡ Syms, Edgar E., 22, *Woodlands-avenue, Wanstead*, E. 11.

1910 Tait, Robt., junr., *Covertside, Moss Lane, Ashton-on-Mersey.*
1908 ‡ Talbot, G., *Mon Plaisir, Wormley, Surrey.*
1920 ‡ Tams, W. H., 19, *Sullivan Road, Hurlingham, S.W.* 6.
1918 Tapp, Capt. William Henry, F.R.A.S., F.R.G.S., 12, *Heddon-street, Regent-street*, W. 1.
1916 Tatchell, Leonard Spencer, 43, *Spratt Hall-road, Wanstead*, E. 11.
1911 Taylor, Frank H., *Box* 137, *G.P.O., Sydney, N.S.W.*
1903 Taylor, Thomas Harold, M.A., *Yorkshire College, Leeds.*
1914 Temperley, Reginald, *The Manor House, Merriott, Somerset.*
1919 ‡ Temple, Major Watkin, *East Mersea, Essex.*
1910 ‡ Theobald, Prof. F. V., M.A., *Wye Court, Wye, Kent.*
1901 Thompson, Matthew Lawson, 40, *Gosford-street, Middlesbrough.*
1892 Thornley, The Rev. A., M.A., F.L.S., *Hughenden, Coppice-road, Nottingham.*
1907 ‡ Tillyard, Robin John, M.A., D.Sc., F.L.S., Chief of the Biological Dept., *Cawthron Inst. of Scientific Research, Nelson, New Zealand*, and *Maitai Lodge, Bridge-street, Nelson, N.Z.*
1920 Tinsley, Joseph, *West of Scotland Agricultural College, Burns-avenue, Kilmarnock.*
1911 ‡ Todd, R. G., 54, *Hornsey-lane, Highgate*, N. 6.
1897 Tomlin, J. R. le B., M.A. (Council 1911–3), *Lakefoot, Hamilton-road, Reading.*
1907 ‡ Tonge, Alfred Ernest (Council, 1915–17), *Aincroft, Reigate, Surrey.*
1920 Tonge, Alfred E., *Ashville, Trafford-road, Allerley Edge, Cheshire.*
1914 de la Torre Bueno, J. R., 11, *North Broadway, White Plains, New York, U.S.A.*

1911 ‡ Tower, P. H., *Marine Cottage, Eastcliff, Dover.*
1919 Tullett, Austin Augustus, *The Hill Museum, Witley, Surrey.*
1906 ‡ Tulloch, Col. B., C.B., C.M.G., *The King's Own Yorkshire Light Infantry, Crown Hill Hutment Camp, Plymouth.*
1895 ‡ Tunaley, Henry, *Castleton, Searle-road, Farnham.*
1910 Turati, Conte Emilio, 4, *Piazza S. Alessandro, Milan, Italy.*
1898 ‡ Turner, A. J., M.D., *Wickham Terrace, Brisbane, Australia.*
1893 ‡ Turner, Henry Jerome (Librarian, 1921– ; Council, 1910–12), 98, *Drakefell-road, New Cross,* S.E. 14.
1906 ‡ Turner, Rowland E. (Council, 1909–10), *British Museum (Natural History), S. Kensington,* S.W. 7.
1921 Tutt, R. F. D., M.R.C.V.S., F.R.M.S., F.Z.S., 1, *St. Cross-road, Winchester, Hants.*
1915 Tytler, Brigadier-Gen. H. C., C.M.G., C.S.I., D.S.O., *Delhi, India.*

1893 ‡ Urich, Frederick William, C.M.Z.S., *Port of Spain, Trinidad, British West Indies.*
1920 ‡ Uvarov, B., *Natural History Museum, S. Kensington, S.W.* 7.

1904†‡ Vaughan, W., *The Old Rectory, Beckington, Bath.*
1914 ‡ Veitch, Robert, B.Sc., Entomologist, c/o C.S.R. Co., *Lautoka Mills, Lautoka, Fiji Islands.*
1909 Vidler, Leopold A., *The Carmelite Stone House, Rye.*
1911 Vitalis de Salvaza, R., *Conservateur, Institut Scientifique, Saigon, Indo-China.*

1897 ‡ Wainwright, Colbran J. (Council, 1901, 1912–14), *Daylesford, Handsworth Wood, Birmingham.*
1918 Walford, Lionel Julian, *The Cavalry Club, Piccadilly,* W.
1878 ‡ Walker, James J., M.A., R.N., F.L.S. (President, 1919–20 ; V.-Pres., 1916, 1921 ; Sec., 1899, 1905–1918 ; Council, 1894, 1921), *Aorangi, Lonsdale-road, Summertown, Oxford.*
1921 Walker, S., 53, *Micklegate Hill, York.*
1912 Wallace, Henry S., c/o R. S. Bagnall & Sons, Ltd., 15, *Grey-street, Newcastle-on-Tyne.*
1920 Wallace, William, M.B., 15, *Hainton-avenue, Grimsby.*
1921 Wallis, H. H., M.A., 145, *Wilmer-road, Heaton, Bradford.*
1914 Walsh, Mrs. Maria Ernestina, *Soekaboemi, Java, Dutch East Indies.*
1920 Walters, Owen Huth, *Forest Office, Lahore, India.*
1919 Ward, James Davis, *Limehurst, Grange-over-Sands, Lancs.*
1910 ‡ Ward, John J., *Rusinurbe House, Somerset-road, Coventry.*
1908 ‡ Warren, Brisbane C. S., *Pikeseot, Pike's Hill-avenue, Lyndhurst.*
1901 † Waterhouse, Gustavus A., B.Sc., F.C.S., *Allonvie, Stanhope-road, Killara, New South Wales, Australia.*
1914 ‡ Waterston, James, B.D., D.Sc. (Council, 1920–), 21, *Arlington Park-mansions, Chiswick,* W. 4; and *British Museum (Natural History), S. Kensington,* S.W. 7.

1921 Watkinson, The Rev. G. M. A., *Woodfield, Hipperholme, near Halifax.*
1919 ‡ Watson, E. B., *The Grange, Winthorpe, Newark.*
1918 Watson, John Henry, 70, *Ashford-road, Withington, Manchester.*
1914 Watt, Morris N., *St. John's Hill, Wanganui, New Zealand.*
1906 ‡ Wheeler, The Rev. George, M.A., F.Z.S. (Secretary, 1911-21; V.-Pres., 1914; Council, 1921), 28, *Gordon-Square*, W.C. 1.
1910 ‡ White, Major Edward Barton, M.R.C.S., *Herrison, Dorchester.*
1918 White, Ronald Senior, *Suduganga Estate, Matale, Ceylon.*
1913 † ‡ Whitley, Percival N., *Brantwood, Halifax*; and *New College, Oxford.*
1921 Whitney, W. B., B.Sc., A.M.Inst.C.E., *Glen Doone, Gerrards Cross, Bucks.*
1913 † Whittaker, Oscar, F.R.M.S., *Box 552, Chilliwack, British Columbia.*
1919 * Whittle, F. G., 7, *Marine-avenue, Southend-on-Sea.*
1917 ‡ Wickham, Rev. Prebendary A. P., *East Brent Vicarage, Highbridge, Somerset.*
1906 Wickwar, Oswin S., *Gresham, Cambridge Place, Colombo, Ceylon.*
1903 ‡ Wiggins, Clare A., M.R.C.S., *Watcombe, Park Town, Oxford.*
1896 ‡ Wileman, A. E., *Lane End, Westcott, nr. Dorking.*
1911 ‡ Williams, C. B., M.A., *Ministry of Agriculture, Cairo, Egypt*, and **20**, *Slatey-road, Birkenhead.*
1915 Williams, Harold Beck, 112a, *Bensham Manor-road, Thornton Heath, Surrey.*
1921 Willmer, E. Nevill, *Trafford Hall, near Chester.*
1921 ‡ Wilson, H. I., O.B.E., M.A., F.Z.S., 139, *Bishop's Mansions, Fulham*, S.W. 7.
1919 † Wilson, Lt.-Col. R. S., *Army and Navy Club, Pall Mall*, S.W.1.
1915 Winn, Albert F., 32, *Springfield Avenue, Westmount, Montreal, Canada.*
1919 Winterscale, J., *Sungei Klah Estate, Sungkai, Perak.*
1920 ‡ Withycombe, Cyril Luckes, 12, *Prospect-hill, Walthamstow.*
1919 Wood, H. Worsley, 31, *Agate-road, Hammersmith*, W. 6.
1905 Woodbridge, Francis Charles, *Briar Close, Latchmore-avenue, Gerrards Cross S.O., Bucks.*
1914 ‡ Woodforde, Francis Cardew, B.A., c/o *University Museum, Hope Department, Oxford.*
1921 Woolett, G. F. C., *Sipitang, Province Clarke, B.N. Borneo.*
1919 Wytsman, P., *Quatre Bras, Tervueven, Belgium.*

ADDITIONS TO THE LIBRARY

During the Years 1920–21.

Ackerman (A. J.). Two Leaf-hoppers injurious to Apple Nursery Stock (*Empoasca mali* and *Empoa rosae*).
[U. S. Dept. Agric., Bull. 805, Washington, 1919.]

Ainslie (C. N.). The Western Grass-stem Sawfly.
[U. S. Dept. Agric., Bull. 841, Washington, 1920.]

Aldrich (J. M.). European Frit-fly in North America.
[Journ. Agric. Research, Washington, Vol. XVIII, 1920.]

——— [See Duzee (M. C. Van).]

Alexander (C. P.). Diptera of the Super-family *Tipuloidea* found in the district of Columbia.
[Proc. U. S. Nat. Mus. Washington, Vol. LVIII, 1920.]

Arkwright (J. A.) and Bacot (A.). A Bacillary Infection of the Copulatory Apparatus of *Pediculus humanus*.
[Parasitology, Vol. XIII, No. 1, Cambridge, 1921.]

———, Atkin (E. E.), and Bacot (A.). An Hereditary *Rickettsia*-like Parasite of the Bed-bug (*Cimex lectularius*).
[Parasitology, Vol. XIII, Cambridge, 1921.] *The Authors.*

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Smith's *Latin*.
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Norwegian, Brynildsen.
Danish, Brynildsen.
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E. A. Elliott (in this and subsequent years), Wytsman's "Genera Insectorum."

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PARTS I, II. October 8, 1921.

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I. *Experiments on the Relative Edibility of Insects, with special reference to their Coloration.* By G. D. HALE CARPENTER, D.M., B.Ch. (Oxon.), F.L.S., F.E.S., F.Z.S., Uganda Medical Service.

[Read June 2nd, 1920.]

[*Note.*—In the absence of Dr. Carpenter in Uganda I have corrected the proofs of his paper and compared all the species Nos. with the material in the Hope Department. In this work much kind assistance was given by Canon K. St. Aubyn Rogers. A few additional determinations in the Acridiidae, due to the kind help of Dr. B. P. Uvarov, have been inserted. One or two notes, signed by my initials, have been added, together with a few references to the literature of the subject. In order to avoid overburdening the paper I have chiefly made use of "Essays on Evolution" (Oxford), which contains full references up to 1908, the year of publication.—E. B. POULTON.]

FOREWORD.

OWING to the great increase in the cost of printing, this paper as originally written has had to be cut down very greatly.

The first 99 observations are given seriatim as originally written, but afterwards only those are included which show some point of especial interest. Three series of tables

have been entirely omitted—two designed to show at a glance how colour and edibility are correlated, and one giving a comparison between the two monkeys. But the complete original manuscript, together with the specimens used, may be seen in the Hope Department, Oxford University Museum.

July, 1920.

Preliminary.

The following experiments, whose object is to test the edibility of procryptic * insects and the relative inedibility of aposematic insects, a young monkey being used as judge, were performed while I was on active service in ex-G.E.A. in medical charge of two small posts near Tabora between Dec. 28, 1916 and Feb. 6, 1917. There was very little work to do, and I was often hard put to it to occupy myself until I discovered that there was a young monkey in the camp. This was a splendid opportunity, and I at once borrowed him and set to work. The monkey was a delightful youngster of the abundant grey species of *Cercopithecus*, with a whitish band over the eyes; he had been obtained when very young, and consequently was perfectly tame and used to being handled, indeed, so accustomed was he to human society, that he was unhappy when alone. For the purposes of the experiments it was necessary to keep him tied up, but previously he had been allowed to run where he pleased.

The Margin of Error.

Experiments upon the edibility of insects to a monkey need to be very carefully and systematically conducted, with full recognition of the very wide margin for error. It is quite useless to offer an insect to an unknown captive monkey in an unknown state of hunger or repletion, and to draw conclusions from that. In the first place, a knowledge of the monkey's individual temperament and habits is essential, in order that one may interpret correctly its behaviour when an insect is offered. The monkey must be so accustomed to the observer that his presence has no disturbing effect; but, on the other hand, one has to

* The terms Procryptic and Aposematic, first used by Prof. E. B. Poulton, F.R.S., in his book, "The Colours of Animals," Lond., 1890, imply respectively a protective resemblance to surroundings, and conspicuous "warning" colours.

remember that after a while the monkey recognises that one is bringing him tasty morsels to eat, and is apt to become very excited, snatch at the insect, and put it into his mouth without having adequately seen it. If he is then very hungry, a hasty observer might conclude that the insect is very edible, whereas under other conditions the monkey might have ignored it.

It is, of course, very advisable to offer the same species repeatedly; but, as a matter of fact, an insect that has been found to be eaten readily, always will be so eaten as long as the monkey will eat anything. Although, as regards the mere fact that they are *eaten*, there is no difference on paper between a relatively distasteful insect eaten under stress of hunger, and an edible insect eaten by a monkey not very hungry, yet to an observer the difference is very marked. The former insect will be taken in hand, looked at, tasted, pulled about, and perhaps eaten piecemeal, with a doubtful expression; whereas the latter will be at once eaten with every indication of pleasure. I may say that the monkey's *facial expression* gives a very accurate indication of whether or not the insect is tasty.

Once I offered the monkey my closed hand. He came up to see what was inside, and I opened my hand and showed him a beetle which previous experiment had proved to be very distasteful. The monkey literally broke into a broad grin and walked away, evidently taking it as a joke!

Another matter of importance is the choice of a time for the experiment when nothing else is likely to distract the monkey's attention, and there should be no one present but the observer. If an insect is offered, and the monkey's attention is suddenly directed to something else, he is very apt to put quickly into his mouth and bite up a species which he did *not* want for food. Again, sometimes when an insect had been offered which the monkey took and dropped, if one made a movement to recover it, for record, the monkey would often, out of sheer mischief, take it and crunch it up, although he had just refused to eat it! Here again a hasty or inexperienced observer might be misled.

Method of Experiment Adopted.

The monkey was kept tied up to a pole, with a shelter-box and perch half-way up it. The ground immediately around the base of the pole was cleared of vegetation, so

that one could put down insects for the monkey (hereafter alluded to as M.) to see as they ran about.

After the first few occasions the method which yielded the best results was soon found. If one wanted to test the *degree of inedibility* of an insect previously shown to be more or less distasteful, it was offered either before the monkey had had any food at all, or after some vegetable food but before any other insects. Refusal under such circumstances implies a high degree of inedibility.

Having started the experiment with such insects, one next proceeded to "take the edge off" the monkey's appetite before offering other insects whose edibility was to be ascertained. *This I look upon as most important*, and I never undertook any experiment, after the first, without having at hand a large number of some insect which I knew M. would always eat greedily. I found Acridiids most useful for this, as numbers of one or other common species can usually be obtained. These will be alluded to as "*Staple food*" or "*Staple Acridians.*"

It was also equally important to have some available at the *end* of the experiment, so that one could prove that M.'s refusal of some insect was not due to repletion. It will be seen later what a surprising amount M. could eat.

The preliminary feeding accomplished, species were then offered the edibility of which one desired to test, and the manner in which M. dealt with each was at once carefully noted in an abbreviated form, before the next species was offered. This I look upon as essential, for if one has a long series to test, one's memory soon becomes confused. These short notes were copied out and elaborated as soon as possible afterwards, while the memory was still fresh.

As regards the typically *Procryptic* insects, it does not much matter in what part of the experiment they are offered, since they are always eagerly eaten. An *Aposematic* species, or one whose edibility is doubtful, is best offered for the first time in the middle of an experiment, and for the second time nearer the beginning or at the very commencement.

Finally, staple food is again given and the inedibility of insects previously refused is judged to be the greater the more staple food is eaten at the end!

Precautions should be taken that M. does not suffer from *thirst*, otherwise errors will be made, for he may then refuse insects which, when not thirsty, he might have

eaten. The monkey was, of course, not allowed to snatch an insect from my hand without having adequately seen it. It was brought in such a way that he could see it well before it came within reach :—often insects were put on the ground out of his reach and allowed (or forced) to crawl gradually towards him. In the case of a *butterfly*, it was found a good plan to cut off the two wings of one side, so that it could be allowed to flutter about on the ground; moreover, the amputated wings could be kept for record : in the case of very active winged insects it was sometimes necessary to quiet them a little with a short period in a cyanide-bottle. Wherever possible the actual specimen that was refused was kept for record. In the case of edible species the ideal was to find a pair in copulâ of which one could be given and the other kept. A second individual could usually be found, but in a few cases, unfortunately, there is no specimen for record.

All insects experimented with were "hand-picked," that is to say I went to look for them and did not collect by beating bushes or sweeping beds of herbs. So that every insect was seen in the surroundings it had chosen for itself, and thus only can one judge with confidence whether a species is aposematic or procryptic.

A very much more interesting method is to take the monkey out hunting on a lead. The monkey, of course, must be very tame, otherwise he is either anxious to escape or else frightened at being taken away from his home. In the place where I first commenced these observations there was an excellent piece of ground, flat, with grass kept short by cattle-grazing, and low bushes dotted about. M. could see his home from there, and though on the first few occasions he was a little frightened of going away from me for more than a few feet, he soon became quite at home. I used to take him out on a long lead, note-book in hand, and note down exactly what he did, what he ate, and what he did not eat. It was necessary to keep him on the rope, as otherwise he would rush about much too quickly and get out of reach. Under these almost natural conditions one got most interesting results, and saw how M. avoided insects that had the appearance of inedibility, and how remarkably quick he was in discovering the edible species. Indeed, his acuity of vision frequently was surprising. He would often leap down from my arms and take one of his favourite Acridians, which I had quite failed to see,

on the stem of a bush a yard or two away. I used to take him to a bush and try to see for myself what was on it, and it was remarkable how I failed to see the fine large Mantid (No. 19) which in form and colour is typically procryptic. This was a very favourite food of the monkey, and I was able to see the very remarkable *defensive attitude* of the Mantid, which could never have been seen had it been taken away from its surroundings and offered to the monkey.

Not only did nothing down below escape M.'s quick eyes, but even when fully occupied with insects he always "kept one eye lifting" for danger from above, and my attention was several times drawn by his quick, nervous glances upwards, to some soaring bird which might be a bird of prey. Thus I feel quite certain that conspicuous insects to which he paid no attention when out hunting were not unseen, but purposely ignored.

Interpretation of Monkey's Behaviour.

As regards interpretation of M.'s behaviour, I soon learnt, from his expression and treatment of an insect, in what category to place it. A very curious method was to paw it violently on the ground with swift repeated strokes of one hand after another. This may be perhaps called a method of attack against insects not necessarily inedible, but whose bite or sting is especially to be feared. No doubt it so confuses them that they may be rapidly picked up and eaten. But this treatment is also directed against species that are particularly distasteful, and indicates profound dislike, quite apart from fear of sting or bite, for I have seen M. violently rub his hands on the ground without once touching the object of his dislike, which was allowed to escape unharmed! Sometimes after pulling a distasteful insect to pieces M. would rub his hands on the ground in the same way, obviously for the sake of cleaning them; it was probably association of ideas which led him to rub his hands on the ground without touching the insect, as just described above.

The most edible insects were at once taken and eaten without a moment's hesitation. Sometimes a species which had not been seen before would be looked at attentively and then eaten with gusto. The next step down the scale is afforded by species at which M. looked, then bit off the head or head and thorax, and finding this edible

ate the remainder without hesitation. Below this are placed insects that were smelt, licked, and tasted, then perhaps pulled to pieces by teeth and fingers and often only partially eaten; or after preliminary tasting such an insect might be put into the mouth whole, only to be pulled out again with an expression of dislike, or surprise, and be re-examined and pulled about. A sure sign of dislike on M.'s part was to run off with an insect to his perch and examine it there, instead of at once dealing with it. After these somewhat distasteful species may be classed those which, after a preliminary smelling and licking, are discarded (often thrown down with a very decisive manner, as if to say "that's enough of *you*"), or allowed to escape; and, finally, those which are not even tasted, but left severely alone, or perhaps merely touched, or turned over by a paw.

Record of Observations.

I will now proceed with the observations, copied, with certain omissions after *Obs.* 99 (p. 23), from my journal. Each species and each observation bears a serial number. All observations of one series (*i. e.* made on one occasion) are embraced under a serial letter. This is Section I of the paper. I then propose to take the species by families and genera, and put together all the notes on one species (including the omissions) so as to arrive at conclusions as to their degree of edibility; this will be Section II. The same method is followed with a second monkey, Section III giving observations, and Section IV the estimated edibility of species arranged by families. Finally, the pith of the results is expressed in charts and diagrams, and some general remarks on cases of mimicry, etc., are made. It is much to be regretted that owing to scarcity of Lepidoptera I was unable to put mimicry to the test in this group, but with some other insects it appeared to be of real value.

SECTION I.

Series A.—This first series was made on Dec. 28, 1916, when I first saw the monkey. His master being away, he had been left in charge of a boy, and had been tied up for several days, almost certainly without any insect food, for which he was *very eager*.

Observation 1. *Species* 1.—A Cassidid beetle, *Cassida* sp.: typically aposematic, found freely exposed on low herbage, bright orange with bold black spots. M. made eager preparations for taking it from off my finger, but as it got nearer it could be more clearly seen, and M. did not snatch at it, but took it carefully, examined it, put it into his mouth without any appearance of eagerness, crunched it slowly and rather doubtfully, eventually either swallowing it or putting it in his cheek-pouch. I gave him another and he examined it and pulled it to pieces, smelt it, and slowly ate it without enthusiasm.

Obs. 2. *Sp.* 2.—Clytrid beetle, *Clytra wahlbergi* Lac.: fairly large, black and scarlet, sits freely exposed on low herbage, typically aposematic, offered to M. on a finger; he examined it and crunched it up without any enthusiasm, and brought it up again into his mouth to be again masticated as if very doubtfully worth eating.

Obs. 3. *Sp.* 3.—Phytophagous beetle, *Physodactyla gerstaeckeri* Jac.: a jumping species, bright orange, very conspicuous and typically aposematic, found on same plant as No. 1, and with it. This was pulled to pieces, smelt, rubbed with the hands, and finally dropped. I picked it up and gave it to M. again; he pulled it about, but finally ate a little.

Obs. 4. *Sp.* 2.—Beetle, *Clytra wahlbergi*. Looked well at, smelt, pulled to pieces, eaten without enthusiasm.

Obs. 5. *Sp.*—.—Acridiid: a small procryptic brown grasshopper was brought to M., who was wildly excited as he saw it coming, seized it with the utmost eagerness and crunched it up with every indication of relish.

Obs. 6. *Sp.* 4.—Hesperid butterfly: a black and white "chequered skipper," was also taken and eaten with gusto.

Series B. *Dec.* 29.—The monkey was now in my hands, and I was able to control its feeding. About 10.30 a.m., M. being very hungry, I gave him a banana, and when about half eaten took it away and offered—

Obs. 7. *Sp.* 5.—Acridian, *Zonocerus elegans* Thunb.: a "poisonous-looking," large, freely exposed, clumsy grasshopper, bright yellow green with undeveloped

reddish tegmina, and antennae ringed alternately black and orange. I put this down in front of M., who just looked at it and appeared to take no more notice.

Obs. 8. *Sp.*—:—I then took out another large Acridian, brown, procryptic. M. at once leapt up and seized it and ate it with extreme haste. Afterwards he went back to 5, smelt and touched it, but did not even taste it.

(*Note.*—This exemplifies extremely well the distastefulness of 5.)

Obs. 9. *Sp.* 1.—*Cassida* sp. This was offered, but M. took absolutely no notice of it.

Obs. 10. *Sp.* 3.—Halticid, *Physodactyla gerstaeckeri.* This beetle was treated like the last.

(*Note.*—This exemplifies that a very distasteful insect may be eaten when the monkey is extremely hungry, see Obs. 1 and 3.)

Obs. 11. *Sp.* 6.—Meloid, *Coryna dorsalis* Gerst.: a very common, medium-sized, large-bodied beetle, black with conspicuous light yellow marks on elytra, was absolutely ignored after a first glance.

Obs. 12. *Sp.* 7.—Meloid, *Mylabris tristigma* Gerst. var.: a common large black and orange beetle, with habits (like 6) typically aposematic, feeding freely exposed on flowers. M. would not even taste this, nor did he touch it.

Obs. 13. *Sp.*—.—An Acridian, of about the same size as 6, procryptic, was at once devoured with great gusto.

Series C. *Dec.* 29.—At about 5 p.m. M. had some banana, and half an hour afterwards—

Obs. 14. *Sp.* 8.—Mutillid: a medium-sized ♀ of a *Mutilla* not in the British Museum, black all over, with white abdominal spots. This was allowed to run on the ground, and M. pounced on it and hurriedly rubbed it on the ground in the manner previously described, eventually seizing it and crunching it up very quickly. I think his lips and one hand got stung.

Obs. 15. *Sp.* 9.—Another, smaller Mutillid was then put down, but M. would not have anything to do with it.

(*Note.*—Obs. 14 was the first occasion on which a

Mutillid was tested, and M. being very young had very possibly not seen one before. After he had been stung he refused a smaller species.)

Obs. 16. *Sp.* 10.—Lycid, *Lycus constrictus* Fähr., ♂: orange colour, with black-tipped elytra; the beetle having typically aposematic habits. I offered it crawling on the tip of my finger, but after a passing glance M. took no more notice. However, I induced him to pick it up, but he at once dropped it again.

Obs. 17. *Sp.*—.—A small procryptic brown Acridian was then eaten with eagerness.

Obs. 18. *Sp.* 11.—Cetoniid, *Glycyphana balteata* Deg.: this beetle of medium size, found on a flowering tree, might be considered to be "Lycoid" in colouring; head and thorax black, elytra orange with a triangular black patch anteriorly. M. picked it up, smelt it, looked carefully at it, pulled it about a little, rubbed it on the ground and then took no more notice of it.

Obs. 19. *Sp.* 12.—Eumolpid, *Pseudocolaspis* sp.: a small, inconspicuous, dull bronze, pubescent Phytophagous beetle. It was taken, nibbled and dropped.

Obs. 20. *Sp.* 13.—Tenebrionid, *Macropoda transversalis* Kolbe: a coal-black but not polished, rotund, long-legged, very active beetle which runs about over the ground and freely exposes itself. M. was not inclined to take it at first, but with a little encouragement ate it slowly and doubtfully.

Obs. 21. *Sp.* 14.—Halticid, *Polyclada* sp.: not in British Museum, Phytophagous. A beetle with orange head and thorax and black elytra; exposes itself freely on herbage. M. picked it up and smelt it, dropped it and picked it up again, pulled it to pieces and ate it with much tasting and doubt.

(*Note.*—Under natural conditions it may, I think, be taken for granted that an insect once purposely dropped would not be retrieved.)

Obs. 22. *Sp.* 15.—Carabid, *Anthia striatopunctata* Guér.: a large, active, common, black carnivorous beetle with elytra bordered with white. A powerful species furnished with large mandibles, and of a type which can eject a strongly irritating fluid. I put it on the ground near M., whose behaviour was most amusing. He rubbed his hands on the ground and

would not go near it! When I made the beetle run towards him, he leapt on to me with every sign of dislike, and almost fear.

(*Note.*—I was once holding a closely allied species in my fingers about 2 feet away from my face, when the beetle ejected fluid which struck my eyebrow and caused a painful burning sensation lasting half an hour, though I at once bathed my face. Proc. Ent. Soc. Lond., 1918, pp. c, ci.)

Obs. 23. *Sp.* 16.—Acridiid, *Phymateus viridipes* Stâl: a large grasshopper, about three inches long, of a hard, unpleasant, green colour, with spiny thorax edged with red. A sluggish species, found freely exposed, often quite in the open. When put on ground in front of M. it at once erected its wings vertically, showing their purplish red and black colour, but made no attempt to escape. M. looked very hard at it, took hold of one wing, let go, and again looked very hard at it, but made no attempt to eat it.

Obs. 24. *Sp.* 17.—To show that M. was not replete I then gave him a large, green, procryptic Tryxalid grasshopper, which he ate with gusto.

Obs. 25. *Sp.* 18.—Acridiid, *Cyrtacanthacris ruficornis* Burm.: lastly I gave M. this very abundant, large, procryptic grasshopper (which the Uganda natives know well and call "E'jansi"), which M. ate, as always, with great gusto, first biting the head off. This species was commonly made use of as "Staple food" afterwards.

(*Note.*—After very definite refusal of Nos. 15 and 16, M. ate with eagerness two insects of approximately the same bulk.).

Series D. Dec. 29.—At 5 p.m. [probably later: see Ser. C, p. 9] I took M. out hunting for himself. He ate a number of quite small insects, including young green Mantids, and one or two large Mantid egg-capsules. He found on the stems of the bushes two more of the Acridian 18, which he ate greedily. While eating one of them, seated on a bush, he suddenly saw a large mantis, *Idolum diabolicum* Saus. (*Obs.* 26. *Sp.* 19). This is an extremely procryptic leaf-green species, with leaf-like expansions on the hind femora: the sides of the thorax are prolonged laterally to form thin flattened expansions. This species frequented a certain bush whose

small, closely set leaves formed admirable cover, amongst which it was extremely difficult to see the mantis, which usually hangs upside down from a stem. On this occasion, as usual, M. saw the mantis before I did, and apparently caught it unawares. It gave him a sharp pinch with its forelegs, and M. shook it away. I

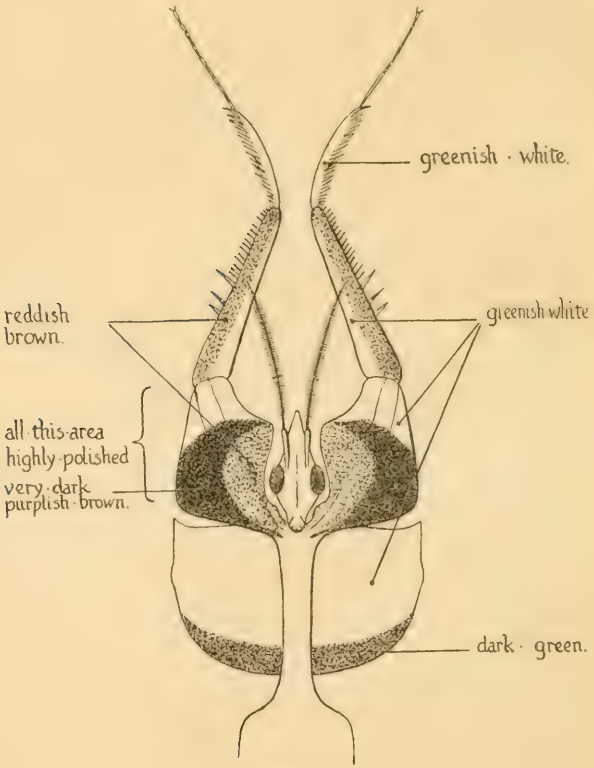


Fig. 1.

then made the mantis crawl along the branch on which M. was sitting, and when it got close to him the monkey apparently made a movement which frightened the mantis. It suddenly reared itself up on its two last pairs of legs, so as to stand at an angle of 45°. The fore legs were held close together, parallel with the long axis of the body, extended on each side of the head,

with the broad flattened coxae rotated so that their *inner* surfaces were directed *forwards*, the two notches together leaving an oval space for the head: the flattened coxae were thus in the same plane as the broad expansions of the thorax. The result of this striking attitude may be seen in the accompanying rough sketch made from this very specimen after it was killed, and the limbs placed in the appropriate position. For some reason the fore limbs could not be made to adopt the straight position in which they were held when alive:—the tibiae and tarsi should be *close together and parallel.* This attitude shows the under surface of the thoracic expansion conspicuously greenish white, except for an inferior greener strip; the coxae basally very dark purplish brown, or almost purplish black, with the dark colour extended to form a semicircle around the reddish brown area on each side of the green head with conspicuous black eyes. The distal parts of the coxae, next the femora, are again conspicuously greenish white, as also is the strip along the inner margin of the femur whose outer part is reddish brown. The whole of the large area of the coxae is very highly polished. The general effect of this large diversely coloured area suddenly exposed in a threatening manner was extremely surprising both to me and the monkey! He hastily backed away along the branch, and I think there can be no doubt that on this occasion the mantis saved itself by its "terrifying attitude."

This most interesting mantis was described by Dr. D. Sharp as a "floral simulator" in the Proceedings of the Cambridge Philosophical Society for 1899, No. X, pp. 175, etc. Dr. Sharp says, "Mr. Muir says, like *Mantis religiosa*, it assumes very peculiar attitudes, sometimes hanging by three or even two legs, and sticking one or more of the others out like twigs.

"The front legs are invariably extended ready to close in upon the deluded prey and are never darted out as they are by *M. religiosa*. . . . I doubt if it has any special plant, but its coloured legs hanging from any tree form an attraction to flies. In order to test this I placed pieces of coloured paper on trees and noticed that flies would often fly down, and at times beetles. . . ."

In a subsequent letter Mr. Muir emphasises the fact that *Idolum diabolicum* captures its prey, as this flies down, by closing the tibia on the femur, and not by darting out the leg as other mantis do.

Dr. Sharp points out that "the points of modification are the great size of the front legs and the colour of the coxae": the appendages on the coxae are especially characteristic of *Idolum* and its immediate allies; the great shield on the thorax reaches maximum development in *Idolum*. The colour of the coxae "has a very floral appearance during life." The attitude is very unusual in that the part of the coxa which is exposed is the *inner* face, which bears the petaloid coloration. If the legs were held in the normal position this coloration would not be seen. "In short the attitude assumed by the insect is thoroughly correlated with the special modification of colour and structure."

Dr. Sharp gives a coloured drawing, in which the femora are stretched out parallel with each other, continuing the line of the coxae, but the tibiae are bent on the femora and do not continue the same line, parallel with each other, as in the "terrifying attitude."

Dr. Sharp makes no mention of this terrifying attitude. I had never heard of *Idolum* before I saw it in 1916, and did not know it was held to be a floral simulator. This never occurred to me—the coloration seemed to me to be entirely for purposes of scaring away enemies. I never noted the attitude described by Mr. Muir.

Obs. 27. *Sp.* 16.—After this interesting episode I took M. to a bush where there were two of the large, aposematic grasshoppers, *Phymateus viridipes*, in copula. M. merely looked at them, and then occupied himself with other things. Just before he moved away he put out his hand to take the ♂, as if forgetting, but at once withdrew it and went his way.

Obs. 28. *Sp.* 18.—Almost at once he caught and ate two *Cyrtacanthacris ruficornis*, each as big as the 16 which he had passed over immediately before.

Series E. *Dec.* 30.—At 10 a.m., the monkey having had a good feed of bananas at 9—

Obs. 29. *Sp.* 10.—Lycid, *Lycus constrictus:* this beetle was offered with elytra pulled off; it gave out a very strong odour. M. would not take it; just touched it and took no more notice.

Obs. 30. *Sp.* 20.—Cicindelid, slightly larger than our *C. campestris;* very procryptic; coloured mottled grey and brown, so that when at rest can hardly be distinguished from its surroundings. M. watched it running about, and then suddenly pounced upon it and vigorously rubbed it on the ground. He then quickly crunched it up with no signs of dislike.

(*Note.*—This well exemplifies how an insect that is eaten without sign of dislike is accorded, from fear of being bitten, the same treatment received by a very distasteful species.)

Series F. Dec. 30.—At 2 p.m., M. having had plenty of food in morning, I gave him (*Obs.* 31. *Sp.* 21) a Histerid, *Hister validus* Erichs.: a large, flat, highly polished, smooth, black beetle, with rather large and conspicuous mandibles. M. looked at it with great interest, touched it, then left it alone. I then took it up and put it down, encouraging M., who, thinking that after all it might be nice, took renewed interest in it. The beetle lay with legs closely pressed to the body, after the typical manner of a *Hister*, and the large mandibles widely separated, quite motionless. M. smelt it, rubbed it on the ground, and then started playing with it, but made no attempt to taste it.

Obs. 32. *Sp.* 22.—Acridiid, *Dictyophorus productus* Bol.: a heavy, bloated, slowly crawling grasshopper that freely exposes itself. The colour is dark grey; the short elytra expose a large part of the abdomen, tinted with a good deal of bright red. M. saw from a distance that I was bringing a grasshopper and became very excited: however, as I got nearer and its nature became plainer his excitement subsided. I put it on the ground, he took it and smelt it, and put it down again. In order to encourage him I pretended to taste it, and he then licked it, but only got a taste of the yellow froth which it exuded in small quantity: he showed every sign of disgust and would have no more to do with the insect, shaking his head as if trying to get rid of the nasty taste.

Series G. Dec. 30, 4 *p.m.*—

Obs. 33. *Sp.* 23.—Acridiid, *Cyrtacanthacris cyanea* Stoll.: another grasshopper of the type

known to the Baganda as "E'jansi"—(see 18)—procryptic, brown with yellow marks, and in flight showing purple wings. This specimen was a ♀ about 4 inches long. M. seized this, with the greatest eagerness, by the body, biting off the head. The insect kicked so strongly with its spiny hind legs that M. was considerably inconvenienced by them and with a little noise of protest bit the hind legs off, eating the muscular femora, and discarding the spiny tibiae, with the exception of which the whole of this large insect was eaten. This species formed one of the staple articles of food in later experiments.

Obs. 34. *Sp.* 24.—Tenebrionid, *Physophrynus*, an undescribed new species: large, rotund, black beetle, much like 13 in habits and general appearance, but considerably larger. M. was not much interested in this; it lay on the ground with legs held stiffly. He looked hard at it, licked it, gave it a gentle bite which made no impression owing to the hardness of the integuments, and then put it down with an air of having had quite enough of it, and rubbed it on the ground. I induced him to try again; he gave it some more gentle bites which made no impression on it, and pulled its head off, but would not eat any of the viscera that came out.

Obs. 35. *Sp.* 25.—Carabid, *Polyhirma*, a species not in the British Museum: a member of a synaposematic group of ground-beetles characterised by black colour with a pair of dull white markings on the elytra, and sometimes an anterior, median, longitudinal, white line along the elytral suture. This specimen was one of the smaller and more delicate members of the group. M. would not touch it, and merely rubbed his hands on the ground.

Obs. 36. *Sp.* 26.—Curculionid: a ground-weevil, earthy brown in colour, with hard and rugose elytra, of slow movement. At rest quite procryptic. This was eaten with relish and without hesitation.

Obs. 37. *Sp.* 27.—Elaterid: a medium-sized, "ordinary looking," brown species of "click beetle." This was also eaten with relish.

Obs. 38. *Sp.* 28.—Hemipteron: a solidly built, rose-pink, wingless bug found freely exposed on a dead tree. I quite expected that M. would have nothing

to do with this very aposematic bug, but he tasted it cautiously, and then ate it slowly and uncertainly. I was much surprised at this, and thought that as M. was in a very frolicsome mood he had perhaps not selected very carefully.

Obs. 39. *Sp.* 29.—Hesperid, *Rhopalocampta forestan* Cram.: this large skipper had been previously quieted a little in the cyanide-bottle. It was inspected, smelt, licked, and finally eaten with relish, wings and all.

(*Note.*—Sufficient time had elapsed for any taint of cyanide to disappear.)

Obs. 40. *Sp.* 30.—Tachinid, *Chromatophania distinguenda* Vill.: a large fly with very conspicuous pink body and brown wings. It had been quieted by the killing-bottle. M. picked it up and threw it down twice, but would not taste it.

Obs. 41. *Sp.* 31.—Reduviid: a slender black bug speckled with yellow; not very conspicuous. M. ate it cautiously.

Obs. 42. *Sp.* 32.—Meloid, *Cyaneolytta coelestina* Haag.: a large, heavy, purple beetle, like *Meloe* (the "oil-beetle"). M. was very decided about this; looked at it and at once rubbed it on the ground and then left it. I put another where he could get at it, and he, being in a very frolicsome mood, played about with it and at last tasted it. He afterwards shook his head and made wry faces.

Obs. 43. *Sp.* 33.—Mantid: two very young black specimens found running on a road. One looked ant-like; the other had a white spot on the abdomen and was rather like a generalised type of *Mutilla*. M. ate them both without delay.

Obs. 44. *Sp.* 34.—Acridiid, *Humbe tenuicornis* Schaum.: a large, earth-brown, very procryptic grasshopper which shows yellow wings with black border when flying. This was eaten with relish.

Obs. 45. *Sp.* 35.—Tryxalid: a large, green and brown, very procryptic grasshopper which shows mauve wings when flying. M. saw the colour of these as I threw it down, but ate the insect with relish, without hesitation.

Series H. Dec. 30.—At 5 p.m. I took M. out hunting among the bushes—

Obs. 46. *Sp.*—.—He discovered and ate at least

four large "jansi" grasshoppers (*Cyrtacanthacris*), and (*Obs.* 47. *Sp.*—) two fat egg-capsules of a mantis, probably Species 19.

(*Note.*—He very soon became extraordinarily fond of these and would eat large numbers. They were spherical, and of about the size of a small walnut; of a creamy white colour and quite conspicuous. He would only eat them when the eggs had not yet hatched.)

Obs. 48. *Sp.* 2.—Clytrid, *Clytra wahlbergi:* one of these beetles was sitting very conspicuously on a low branch, and as M. was then on my arm I directed his attention to it. But he only looked past it at a small grasshopper, to get which he jumped down, and ate it. I could not make him take any notice of the aposematic beetle even when I threw it down in front of him.

Series J. *Dec.* 31.—At 8 a.m. M. had some banana, but was *very hungry for insects.*

Obs. 49. *Sp.* 5 was offered, but M. was obviously disappointed and would not take it.

Obs. 50. *Sp.*—.—A green Tryxalid grasshopper was eagerly devoured.

Obs. 51. *Sp.* 14.—Was dropped on ground. M. ate it, but without eagerness.

Obs. 52. *Sp.* 2.—Put on ground, but M. would have nothing to do with it.

Obs. 53. *Sp.* 36.—Tenebrionid, *Lamprobothris fossulata* Müll.: an elongated, dull purple, shagreen beetle found on stem of a bush, not very conspicuous. M. at first ignored it, then bit its head off and ate it slowly, without enthusiasm.

After this I gave M. more banana and some small Acridians.

Series K. *Dec.* 31.—At noon I gave M. a "jansi." He was very eager for it, squealing excitedly as I brought it near, and ate it greedily.

Obs. 54. *Sp.* 37.—Galerucid, *Megalognatha* sp.: a small, abundant, freely exposed beetle frequenting low bushes. Head, thorax and antennae black, elytra light brown. In the pregnant ♀ the abdomen, much swollen with eggs, is bright yellow, with the segmental rings black. M. would have nothing to do with this, not even smelling it.

Obs. 55. *Sp.* 38.—Cassidid, *Aspidomorpha hybrida* Boh.: a medium-sized, dull-bronze "tortoise-beetle." It was offered on my finger; M. at first ignored it, then tasted and dropped it.

Obs. 56. *Sp.* 39. Reduviid: an elegant, grey bug with reddish patch at tip of tegmina. Eaten with no sign of dislike.

Obs. 57. *Sp.* 40.—Pentatomid larva: a flat, grey bug with enormously long rostrum, quite procryptic, bark-like. A young specimen, as tegmina not developed. Eaten, but slowly and without relish.

Obs. 58. *Sp.* 41.—Pentatomid, *Callidea bohemani* Stal: a large, bright green and gold bug. M. looked at it disappointedly when I took it out of the box, but took it, smelt it, and dropped it with an air of finality.

Obs. 59. *Sp.* 38.—Cassidid, *Aspidomorpha hybrida:* another specimen of this tortoise-beetle was pulled to pieces, uneaten.

Obs. 60. *Sp.*—.—A large *Cyrtacanthacris* grasshopper was eaten with great eagerness.

Obs. 61. *Sp.* 42.—Coreid, *Anoplocnemis curvipes* F.: a large, plant-feeding bug, black, with the hind femora much thickened in the male. Quite conspicuous, as it sits among green leaves, preferably on tips of young shoots, but takes to the wing more readily than a typically aposematic species. M. appeared to recognise that this might be formidable—it was vigorously rubbed on the ground, then eaten, but not with gusto.

Obs. 62. *Sp.* 43.—Buprestid, *Sternocera pulchra* Waterh.: a very large, conspicuous beetle. Thorax covered with orange pubescence, elytra blue-green. Flies very conspicuously with loud hum, and sits on twigs freely exposed. I quite expected M. to refuse this beetle. He looked at it, patted it, smelt it, and then backed away from it; and I could not induce him to taste it. The beetle opened widely the gap between posterior edge of thorax and anterior margin of elytra, but I could detect no odour.

Obs. 63. *Sp.*—.—A small, procryptic Acridian then eaten with great zest.

Series L. Dec. 31.—In the afternoon—

Obs. 64. *Sp.* 44.—Pentatomid, *Aspongopus viduatus*

F.: a large, flat, black and brown bug, caught on the wing. It was put down in front of M. (who had seen it flying), and he, very eagerly, and without having examined it much, gave it a nip. The result was apparently unpleasant, for he threw it down and ran away. I was not sure whether the bug had pricked him with its rostrum, or whether he objected to its strong flavour; he smelt strongly after biting it, and his mouth was obviously very uncomfortable.

Obs. 65. *Sp.* 45.—Carabid, *Polyhirma calliaudi* Casteln.: a medium-sized ground-beetle, black, with dull white marks, of the same general type of colour as 25, but larger. M. would have nothing at all to do with it, and did not even rub it on the ground, in spite of my attempts to induce him to pick it up.

Series M. Dec. 31.—

Obs. 66. *Sp.*—.—At 4 p.m. gave M. a *Cyrtacanthacris* grasshopper and then—

Obs. 67. *Sp.* 43.—Buprestid: the large beetle *Sternocera pulchra*, but M. only touched it and would have no more to do with it.

Obs. 68. *Sp.* 46.—Tenebrionid, *Vieta* sp. ? *vestita* Gory: a medium-sized ground-beetle, earth-coloured, with very rough and bristly elytra. M. touched it as it ran, and apparently did not like the feel of it, for he at once rubbed it on the ground and would have no more to do with it.

Obs. 69. *Sp.* 47.—Buprestid, *Agrilus discolor* Fähr.: a beetle of bright colouring, quite conspicuous on a leaf. Grey and black with orange markings; abdomen ventrally black and brilliant white. The dorsal colouring is rather reminiscent of a type of colouring common among Hemiptera. A pair was found in copula, and the larger female offered to M., who looked at it with great interest, took it and bit its head off, then slowly pulled it to pieces and ate it bit by bit as if not sure about it.

Series N. Jan. 1.—At 7 a.m., before M. had eaten anything, I gave him the Buprestid beetle 43 *Sternocera pulchra*. (*Obs.* 70. *Sp.* 43). Though very hungry he did not really want it, but after hesitation tried to bite off its head. This was difficult, as the beetle was very hard and slippery and he couldn't get a grip. Also he got the tip of his tongue nipped between the beetle's

thorax and abdomen ! However, by persistent efforts he at last bit the head off and ate the beetle very slowly and with no evidence of pleasure. Later, he ate a banana and (*Obs.* 71. *Sp.*—) two small Acridians, and then I offered—

Obs. 72. *Sp.* 48.—Chrysomelid, probably *Lygaria* sp., not in British Museum : a pink and black, medium-sized beetle like a ladybird, one of two found in copula. M. looked at it for some time and then cautiously ate it without apparent enjoyment.

Obs. 73. *Sp.* 49.—Lampyrid, *Luciola* sp., not in British Museum : a firefly about the size of the English ♂ glow-worm, dull grey, with yellow thorax. This was smelt and most definitely refused.

Series O. Jan. 1.—At 9 a.m. I took M. out hunting on a lead—

Obs. 74. *Sp.* 50.—Coccinellid, *Alesia striata* F. : a common, small, rose-pink ladybird, with three black longitudinal stripes, found on tops of long grass. I offered this to M. and rather to my surprise he ate it.

Obs. 75. *Sp.*—.—He then found and ate a *Cyrtacanthacris* grasshopper.

Obs. 76. *Sp.*—.—While eating this he saw a mantis egg-capsule, and took that.

Obs. 77. *Sp.* 42.—Coreid : soon after, he saw a black bug (*Anoplocnemis curvipes*) and attempted to catch it, but it flew away.

Obs. 78. *Sp.* 14.—Halticid : I found one of these *Polyclada* beetles, but could not induce M. to take it.

Series P. Jan. 1.—In the evening, after M. had had a good feed of bananas and at least one *Cyrtacanthacris* grasshopper in the afternoon, I again took him out hunting. In this series, each different bush visited is indicated by a letter.

Obs. 79. *Sp.*—.—A. M. ate a ♂ *Cyrtacanthacris* and another smaller Acridian.

Obs. 80, *Sp.*—.—B. Ate two *Cyrtacanthacris* in quick succession.

Obs. 81. *Sp.*—.—C. Investigated an empty spider's "nest."

Obs. 82. *Sp.*—.—D. Ate a mantis egg-capsule.

Obs. 83. *Sp.* 51.—E. Coccinellid : a large, bright pink and yellow ladybird with black pattern was eaten. I then let M. loose. He ate some leaves of a

herb tasting like sorrel, and began to get very playful and inclined to play hide-and-seek.

Obs. 84. *Sp.*—.—F. A mantis egg-capsule, probably empty, munched, and thrown away.

Obs. 85. *Sp.*—.—G. Another similarly treated. M. then ate some grass, unsuccessfully chased some small grasshoppers (Acridiidae) and ate some more grass, keeping one eye on a large crane high overhead, which I had not seen.

Obs. 86. *Sp.*—.—H. Ate a *Cyrtacanthacris* grasshopper.

Obs. 87. *Sp.*—.—I. Investigated an empty spider's retreat.

Obs. 88. *Sp.*—.—J. Ate a large mantis egg-capsule, of the size of a small walnut.

Obs. 89. *Sp.*—.—Found another, bit and left it.

Obs. 90. *Sp.*—.—I showed him on the ground a smooth caterpillar, dark brown and reddish, but he would not touch it. Though freely exposed it was not extremely conspicuous.

Obs. 91. *Sp.*—.—K. Ate a medium-sized, brown Acridian.

Obs. 92. *Sp.* 19.—He then walked about, constantly looking up at the under-side of a leafy branch close to the ground, whereon was something I could not see, or perhaps had failed to see. Suddenly there was a pounce, and I saw that he had pulled on to the ground one of the large mantises *Idolum diabolicum*, which lay on the ground in two pieces, which he ate greedily.

Obs. 93. *Sp.*—.—He then ate two more mantis egg-capsules.

Obs. 94. *Sp.*—.—L. Investigated an empty spider retreat.

Obs. 95. *Sp.* 19.—M. On this bush, hanging upside down on a branch near the ground, was another *Idolum* mantis. M. at first was not at all sure that he wanted it, but at last knocked it on to the ground. Here it stood in the erect posture previously described, facing the monkey and me, looking very ferocious and formidable; the white under-surface of the thoracic expansions being especially noticeable. M. had quite a little fight with the mantis, going "in" and "out" like a pugilist. During the fight I heard a curious

noise (which I described in my notes as like a small sneeze with a click in it) which I believed was made by the mantis, but could not see how. The poor mantis was eventually overpowered and eaten.

Obs. 96. *Sp.*—.—The monkey then ate another *Cyrtacanthacris.*

Obs. 97. *Sp.*—.—N. Another eaten.

Obs. 98. *Sp.* 52.—Longicorn, Lamiid, *Dirphya similis* Gah. : while M. was on a branch there suddenly flew out this large beetle, with loud buzzing. On the wing it was very conspicuous and resembled a large Braconid. The long antennae black, the head, thorax and anterior half of the elytra bright orange, posterior half of elytra black. On the sides of the abdomen are glistening white marks. I caught the beetle, and put it on the ground in front of M., who merely looked at it. When I put it on my finger (which it bit very hard), stridulating loudly, M. would not go near it and backed away if I approached it to him.

Obs. 99. *Sp.* 52.—Next morning, early, before M. had had anything at all to eat, I offered this beetle again. Being very hungry he took it, smelt it, and rather doubtfully bit its head off, and ate it slowly.

(*Note.*—These two observations are very instructive in showing the difference made to a monkey by hunger. It is extremely likely that in the evening he had actually *seen* the beetle and passed it by, for it is large and does not hide itself.)

From this point the observations have only been quoted in cases of particular interest.

Series Q. Obs. 100–114. *Jan.* 2.—At 10.30 a.m. M. was taken out on the lead. He had had very little *insect* food, and was hungry.

Obs. 113. *Sp.* 58.—[The Acridians *Tanita* sp. and *T. semlikiana* Rehn bear this number. Both have red wings and tegmina either grey or green.—E.B.P.] A very procryptic, stone-grey, small Acridian got up in front of me as I walked, and I let M. get down to catch it where it had settled. He failed to find it, and saw its conspicuous red wings as it flew away. He then caught it, but did not eat it at once, looking at it *as if to see where the red wings had gone to.*

(*Note.*—I consider this point of great importance. See later.)

Series R. Obs. 115. *Jan.* 2.—In the evening, M. having had as much vegetable food as he could eat, I took him a large Sphingid caterpillar of the *Deilephila* type (*Sp.* 60), pale apple-green, with the usual spots on two of the enlarged anterior segments. These spots, however, could not be described as "Eye-spots" (though they could develop into such), as they consisted merely of dull yellow patches ringed with black. M. was *very* excited when he saw me bringing the caterpillar on its food-plant, and I kept it for a while just out of reach to let him see it well. I then let him take the stem on which was the caterpillar; he looked at the latter attentively and licked its head. It drew back the head into the enlarged segments behind, and bent the anterior part of the body round, parallel to the posterior part. This did not, however, prevent the monkey eating it with enjoyment, though he seemed to find much the same difficulty with it as a boy with a chocolate éclair! Watching him I concluded that he was not familiar with such soft, squashy insects.

(*Note.*—This attitude of the caterpillar was extremely interesting because although, in this species, it was of little importance, in others which have eye-like marks the swelling of the segments bearing them, caused by the attitude, must very considerably increase the "alarming" effect of the eyes. (See Poulton's "Essays on Evolution," Oxford, 1908, p. 367.) It is tempting to suppose that this attitude, common to this type of larva, preceded the development of the spots described above into a more eye-like stage, which would thus be rendered more effective.)

Series S. Obs. 116–134. *Jan.* 3.

Obs. 116. *Sp.* 22.—At 7 a.m., before M. had had any food at all, I offered the Acridian, *Dictyophorus productus*. M. looked very hard at it, took it, turned it over and over, and pulled its legs. He then licked a little of the froth which exuded, white, from the side of the thorax, and dropped the grasshopper for good. He then ate some banana.

(*Note.*—The fact that the legs of this species did not come off when pulled may be another example of the

well-known toughness of aposematic species. In a typically procryptic, jumping grasshopper the hind legs are easily dispensed with. *Dictyophorus* does not readily exude froth, and when it does so, only a little, cp. *Sp.* 22, p. 15.)

Obs. 117. *Sp.* 61.—At 8 a.m., M. having eaten no insects, I gave him the Syrphid fly, *Eristalis tenax*, much resembling the honey-bee. I held it by the legs so that it buzzed. M. was not at all keen, but took it in his hand and then suddenly let it go precisely as if he had been stung. I think he was very uncertain about this mimetic insect, and perhaps it buzzed in his hand and his imagination was too strong for him!

Obs. 128. *Sp.* 65.—Lygaeid, not in British Museum: probably a *Lygaeus*, a conspicuous black and red bug. One which had been turned out on to the ground took to flight suddenly; M. pounced on it and hastily bit off its head. This he violently spat out, and his gestures and expression gave every sign of a very disgusting taste. He then went and ate some mango!

Obs. 129. *Sp.* 67.—Asilid, *Hoplistomerus serripes* F.: a large predaceous fly whose abdomen is covered with dense golden pubescence; the wings are clouded. Found sitting on a leaf one evening it much resembled a Scoliid, the large bristles characteristic of Asilid flies being suppressed. I opened the box in which it was and let M. see it. He looked closely at it, but with suspicion. Just as it was about to fly I caught it by the legs, so that the yellow surface of the abdomen, concealed when the wings were at rest over the back, was visible. M. would not catch hold of the fly, though he once put out his hand and touched it. Eventually it flew away. M.'s behaviour most strongly suggested that he was afraid of this harmless insect.

Series T. *Obs.* 135–138. *Jan.* 3.

Series U. *Obs.* 139–148. *Jan.* 3.—At 5 p.m., after M. had eaten some banana—

Obs. 142. *Sp.* 73.—Asilid: a large, hairy, predaceous fly, grey in colour. This had been quieted in the killing-bottle so that when I opened the box in which it was it crawled out. Just as it made ready to fly M. seized and ate it eagerly.

(*Note.*—This is interesting because M. had refused to have anything to do with the previous Asilid,

mimetic of a Scoliid. It strengthens the supposition that the mimicry was real enough to make M. suspicious.)

Obs. 144. *Sp.* 42.—Coreid, *Anoplocnemis curvipes:* while M. was eating a favourite *Cyrtacanthacris* grasshopper with a piece in each hand, I put down one of these black malodorous bugs. M. was very amusing, as he was afraid it would get away and yet did not want to relinquish what he was actually eating. At last, at its third attempt to fly away (I had frustrated previous efforts) M. dropped the remains of his grasshopper to seize the bug, which, as before, was eaten with great eagerness.

(*Note.*—The fact that M. dropped a piece of his favourite food to secure this bug shows what he thought of it.)

Obs. 145. *Sp.* 24.—Tenebrionid, a species of *Physophrynus:* the beetle was put on the ground, but M. only just looked at it. Eventually, being in playful mood, he threw it about and rolled over with it, but would not taste it.

Obs. 146. *Sp.* 74.—Curculionid: a very large ground-weevil, in general appearance remarkably resembling 24, dull grey-black, and of slow habit. After close inspection M. tried to bite it, but it was so hard that at first he could make no impression on it. He at length "cracked" it, and broke off the elytra and dorsal plate of the abdomen, exposing bright yellow viscera. He seemed rather surprised at this, but ate them, with much tasting.

Obs. 147. *Sp.* 75.—Lamiid, probably *Phantasis zanzibarica* Gerst.: a very remarkable, rotund, bulky, grey-black Longicorn beetle, having a strong general resemblance to 74 (and, in less degree, to 24) save for the antennae, which were short for a beetle of this family. It was found walking slowly across a road, within a few yards of 74. It had lost the power of stridulating possessed by the family as a whole. The shallow longitudinal grooves of the elytra are set with fine bristles. I put it down before M., who merely looked at it, without any desire to eat it. At last he touched it, and apparently not liking the bristly feel of it, rubbed it on the ground and left it.

(*Note.*—These last two species, though not apose-

matic by colouring, yet are by habit. The weevil would seem to be protected by its extreme hardness: the Longicorn (also found to be very hard) apparently by its bristles. The very unusual shape of the Longicorn raises the question whether it may not be influenced by the abundant 74. See "Essays on Evolution," pp. 369, 370.)

Obs. 148. *Sp.*—.—Lastly, I gave M. an Acridian. He seemed nearly "full," for though it was a species which he eats readily as a rule, he was not very eager for this one.

Series V. *Obs.* 149–153. *Jan.* 4.

Series W. *Obs.* 154–155. *Jan.* 4.

Series X. *Obs.* 156–175. *Jan.* 4.—At 4.30 p.m. I took M. out hunting. He had had plenty of vegetable food in the afternoon, but no insects.

Obs. 156. *Sp.* 6.—Meloid: on the first bush were several of the beetle *Coryna dorsalis*. I induced M. to put out a hand and touch one, but he would not even smell it.

Obs. 157. *Sp.* 42.—Coreid, *Anoplocnemis curvipes*: M. saw this bug, caught it, and ate it very quickly, as if afraid of being pricked.

Obs. 158. *Sp.*—.—He chased and ate a small Acridian, then ate some grass.

Obs. 159. *Sp.* 78.—An Arctiid caterpillar, about an inch long, was touched and left.

Obs. 160. *Sp.* 16.—Acridiid, *Phymateus viridipes*: a pair of these aposematic grasshoppers were in copula freely exposed on short grass in the open. M. went up to them and pawed the male. Without attempting to get away the grasshopper merely erected its wings perpendicularly so as to display their purplish and black colours. M. took no more notice and ate some grass. Afterwards he ate other insects, including a large *Cyrtacanthacris* grasshopper.

(*Note.*—This exemplifies excellently the instinct of an aposematic insect to make the most of its colours without attempting to escape. Had it done so, the monkey might well have pounced on it and maimed it, even though he would not eat it afterwards. The coloured wings are extremely conspicuous when the insect is on the wing, its flight being slow and laborious, and direct one's attention very emphatically to it.)

Obs. 168. *Sp.* 81.—Phasmid: I saw M. looking very carefully at the top twig of a low bush, round the foot of which he walked, and then suddenly took from it a brown stick-insect about two inches long, a species commonly found among grass. Presumably at first M. was not sure of it and it then gave itself away by moving.

Series Y. *Obs.* 176. *Jan.* 5.

Series Z. *Jan.* 12.—Since last observation I had been away. The monkey had had very little insect food during that period. In afternoon, M. having had some banana, I offered him—

Obs. 177. *Sp.* 86.—Lycid, *Chlamydolycus trabeatus* Guér.: a ♂, with elytra enormously developed, projecting far beyond the small body—a very conspicuous beetle. M. looked well at it, at last taking it in his hand and dropping it again. I could not induce him to do more than smell it once, when he instantly dropped it.

Obs. 178. *Sp.* 87.—Lygaeid, *Oncopeltus famelicus* F.: conspicuous black and orange bug. M. was not at all eager for this, but took it, pulled it about, bit its head off, and then had no more to do with it.

Obs. 179. *Sp.* 88.—? Coccinellid, or allied family: a very highly polished, shining, black, hemispherical beetle, with two small red spots. It gave out yellow juice when handled. To my surprise M. ate this with no sign of distaste.

Obs. 180. *Sp.* 89.—Carabid: small, dull-black ground-beetle like a *Harpalus*. M. also ate this.

(*Note.*—Seeing how hungry for insects the monkey was, as evidenced by his eating the Carabid, his refusal of the Lycid is the more emphatic.)

Series Aa. *Jan.* 13.—At 8 a.m., M. having had no insect food—

Obs. 181. *Sp.* 86.—Lycid, *Chlamydolycus trabeatus:* as M. was hungry he pulled this beetle to pieces, and smelt each bit, but tasted none.

Obs. 182. *Sp.* 44.—Pentatomid, *Aspongopus viduatus:* shown to M. in a box. He looked at it for a very long time; the bug moved a little, and vibrated its short antennae very rapidly, and M. turned away from it. I brought it to his notice again, and he pawed it a little: just as I was taking it away for

record, M., purely out of mischief, and because he saw I wanted it, took it and bit it up. I am quite certain he did not want it as food: and he did not bite it up with any relish!

Obs. 183. *Sp.* 21.—Histerid, *Hister validus:* during the day I saw M. playing about with one of these polished black beetles, and pawing it on the ground, but making no attempt to eat it. It had flown by, and alighted on the ground within his reach.

Series Ab. Obs. 184–189. *Jan.* 13.—At 10.30 a.m. I took M. out hunting—

Obs. 185. *Sp.* 23.—M. caught and ate the huge Acridian *Cyrtacanthacris cyanea*, a ♀, absolutely ignoring (*Obs.* 186. *Sp.* 22) the aposematic grasshopper *Dictyophorus productus*, which was on the ground just in front of him.

Series Ac. Obs. 190–200. *Jan.* 13.—At 2 p.m. I took M. out hunting again, but he was rather sleepy—

Obs. 193. *Sp.* 91.—Acridiid, *Lamarckiana loboscelis* Schaum.: a ♀, of huge size, heavy and corpulent, without a trace of wings. This species is coloured so as to resemble a clod of earth; sometimes light, sometimes dark, but always with a darker patch on the thorax. I have often seen them sitting on bare ground and mistaken them for clods until they moved. They hop very feebly and cannot possibly escape an enemy.

M. found this one on the ground and began to eat it before I saw it. He bit the head first, but did not bite it off, as he does with his favourite *Cyrtacanthacris*. He seemed rather doubtful about it, and turned to a leg, eating one thigh; then bit off the end of the abdomen, pulled out and ate the viscera, but his manner of eating was not nearly so enthusiastic as when dealing with *Cyrtacanthacris*. He finally bit off and ate the head.

(*Note.*—The case of this huge, helpless Acridian seems to me extremely interesting—a species which, in its present condition, is procryptic, and yet appears not to be so edible as its colouring suggests. Now it is an *extremely variable species:* under certain conditions it may be conspicuous. I have seen a quite light grey-brown specimen on dark soil, and it was then far from being procryptic. As I have said, it

always has a dark patch on the sides of the thorax; and being so variable, one can readily imagine the light colour being accentuated, until a strongly contrasted scheme of black-and-white, typically aposematic, could easily be produced. This having been attained it would obviously be to the advantage of the conspicuous insect if further development of the distasteful quality, apparently already present to a slight degree, could be brought about. So that in the last stages this species might be as typically distasteful and aposematic as the Acridian No. 5, which still retains imperfectly formed wings.)

Obs. 194. *Sp.* 19.—Mantid: while M. was dealing with 91, which he ate sitting on a bush, he kept looking with great interest at a fine ♀ mantis, *Idolum diabolicum* (19), which was hanging from the same branch on which he was sitting. Its head was towards M., and it had stretched out its fore limbs in the terrifying attitude previously described, so that M. looked straight down upon the coloured surfaces. While he continued to eat 91, I made a slight movement, and the mantis at once wheeled round to present *me* with its coloured surfaces. At intervals I heard the curious sound described in Obs. 95; it is perhaps better described as like the noise made by drawing a hard edge rapidly over the fine teeth of a comb.

I was much pleased to see that this noise actually *was* made by the mantis, by drawing the left posterior leg rapidly along the outer edge of the left tegmen (the two tegmina being slightly separated); the point where the leg touched the tegmen was just proximal to the leaf-like expansion on the leg. Like myself, M. observed all this with interest while he was eating 91, but at last could wait no longer, dropped the remainder of 91, and seized the poor mantis, and devoured it very rapidly: *too* rapidly, for he was almost immediately sick! I expect the horny legs (for he ate even the spiny fore-legs) were too much for his stomach.

(*Note.*—It seems as if familiarity with this mantis had bred contempt. The monkey had seen several of them, for they were quite abundant on the particular low bushes where I took him to hunt. Under natural conditions a monkey might only come across

one or two in his lifetime, and leave them alone, as my monkey did the first time he met one. It is difficult to believe that the elaborate development of colour, shape, attitude, and specialised movement and structure to make a noise, could have been developed unless it had been able to scare away enemies at least fairly often. When at rest the mantis is extremely procryptic, the concealment being especially aided by the sundry expansions of the cuticle on its body and legs. But the much-expanded front coxae take no especial part in this procrypsis, for when the mantis is at rest they lie in the *vertical* plane; and are not conspicuous, their strongly contrasted coloured surfaces facing each other, the outer surface being green. Only when the mantis is alarmed are they rotated through a right angle to contribute to the terrifying attitude. It is interesting that when the front legs are held in the terrifying position their formidable prehensile qualities are entirely thrown away !)

Series Ad. *Obs.* 201–211. *Jan.* 14.

Series Ae. *Obs.* 212–229. *Jan.* 14.—At 12.30, M. being very hungry—

Obs. 212. *Sp.* 100.—Carabid: a larva about an inch long, black, polished, and active. Allowed to run on the ground. M. looked at it, and rubbed it on the ground without attempting to eat it.

Obs. 213. *Sp.* 101.—Lygaeid, *Lygaeus militaris* F.: a grey-black and rose bug. M. looked at it and rubbed it on the ground, making no attempt to eat it.

Obs. 214. *Sp.* 48.—Chrysomelid, *Lygaria* sp.: M. ate one of these beetles slowly and doubtfully; also a second which was offered.

Obs. 215. *Sp.*—.—Acridiid: a large *Cyrtacanthacris* greedily eaten.

Obs. 216. *Sp.* 61.—Syrphid, *Eristalis tenax:* this drone-fly had been quieted by a short time in the cyanide-bottle, and was put on the ground so that M. could watch it crawling about. He looked at it with great suspicion, then took it in his hand, but threw it down exactly as if it had stung him and rubbed it on the ground. The drone-fly then flew away.

(*Note.*—Exactly the same thing happened as on the previous occasion. (See Obs. 117.) Presumably

the drone-fly buzzed in the monkey's hand, and he threw it down, fearing a sting: the fact that he subsequently accorded it the treatment given to insects of whose sting or bite he is afraid, shows how entirely M. was deceived by the bee-like appearance of this fly.)

Obs. 217. *Sp.* 5.—Acridiid, young, possibly the first stage of 5, *Zonocerus elegans:* I found several score of these grasshoppers clustered thickly together to form a conspicuous mass among grass; they are black, finely spotted with yellow. I put down a number on the ground in front of M., who was not at all excited (as he would have been were they edible), but took one, pulled it about, smelt it, played with it, but did not even taste it.

(*Note.*—This exemplifies well how distasteful insects, each individually not very conspicuous (in this case because of small size), are able to achieve the aposematic effect by massing themselves together. ("Essays on Evolution," pp. 318-20.) Procryptic insects are not found to do so, except in rare cases where an assemblage would increase the procryptic effect, or at least not diminish it.)

Obs. 218. *Sp.* 103.—Pierid, *Terias senegalensis* Boisd.: a common small sulphur-yellow butterfly, of weak flight. M. ate it with no sign of distaste, wings and all.

Obs. 219. *Sp.* 104.—Acraeine, *Acraea caldarena* Hew., *neluska* Oberth.: a pink butterfly of medium size, black-spotted. I have noticed that, for an *Acraea*, this is very agile and difficult to catch. M. seized it at once (the wings of one side had been amputated so that it fluttered without being able to escape), bit its head off, and promptly spat it out! the body was pulled to pieces, tasted, and decidedly rejected.

Obs. 220. *Sp.* 105.—Coprid, *Phalops laminifrons* Fairm.: a small, bright metallic green dung-beetle. Put on the ground, M. rubbed it violently with every sign of marked dislike. I induced him to take it and smell it, but nothing more.

Series Af. *Obs.* 230–250. *Jan.* 15.—At 7 a.m. took M. out hunting, he not having eaten.

Obs. 243. *Sp.* 19.—Mantid, *Idolum diabolicum:* M. seized this very suddenly and ate it quickly before

it had had opportunity to stridulate more than two or three times. He must have seen it from some distance away, for he jumped on to the branch and made straight for it, giving it no time to fight him. He did not, on this occasion, eat the horny front legs: perhaps he remembered vomiting on the last occasion (Obs. 194).

Series Ag. *Obs.* 251–254. *Jan.* 15.

Series Ah. *Obs.* 255–263. *Jan.* 15.—At noon, M. being hungry—

Obs. 259. *Sp.* 61.—Syrphid, *Eristalis tenax:* this drone-fly had been quieted in a killing-bottle, but could crawl about. M. looked at it very suspiciously as it sat on the grass, then took it in his hand and threw it down precisely as he had done before (Obs. 117, 216). I induced him to take it up again: he gave it a little nip very gingerly, and threw it down.

Obs. 260. *Sp.* 120.—Nymphaline, *Hypolimnas misippus*, ♀: the well-known brown, black, and white mimic of *D. chrysippus*. The wings of one side had been cut off. The butterfly was offered to M. so that he could see it plainly. He took it and looked at it very thoroughly, and then put it into his mouth, holding the body in his teeth and pulling off the wings. He ate it slowly, with a good deal of mouthing, and evidently did not find it very palatable.

Series Ak. *Obs.* 264–282. *Jan.* 15.—At 5 p.m. I took M. out hunting; owing to a thunder-cloud he was not very eager.

Obs. 271. *Sp.* 6.—Meloid, *Coryna dorsalis:* M. saw this conspicuous beetle on a bare stem. He ran to it and touched it. It dropped and he left it.

(*Note.*—This was the first occasion when hunting that M. had taken any notice of this common and conspicuous beetle, which could be seen everywhere on low herbage.)

We then had to shelter from a storm, after which I took M. to an old patch of cultivation, now weed-grown.

Obs. 272. *Sp.* 58.—Acridiid: M. caught a ♂ of this grasshopper, a species of *Tanita*, procryptic, and ate part of it. He then saw the red wings, and hesitated a little, then continued, rather in doubt, and finally dropped it. Remains kept for record.

(*Note.*—This observation is of peculiar interest. There is a small, grey or greenish-brown grasshopper which, at rest, is extremely procryptic, and difficult to see. Yet when it takes to flight with a clapping noise its red wings seem at once to give it away. I had previously been a good deal puzzled by this: the explanation seemed to lie in the rapid flight and sudden disappearance of the insect when it closes its wings confusing the observer—as it certainly always does me when I try to find them at the place where I think they must be, judging from the point where I last saw the red wings! ("Essays on Evolution," pp. 303-4.) As a matter of fact they never *are* there, for the moment they have landed from their flight they hurriedly creep away and hide. The monkey, however, seemed most definitely to regard the red wings as an aposeme (cp. also Obs. 113). He began to eat what appeared to be a procryptic insect, saw an aposeme, and found the insect was not so edible after all! It would be most interesting to know whether this insect, now in an apparently intermediate stage as regards edibility, is losing its former edibility combined with procrypsis, or is becoming procryptic and edible from a more distasteful ancestor! I incline to the former alternative.)

Obs. 273. *Sp.* 16.—Acridiid, *Phymateus viridipes:* one of these was on a branch above M.'s head. He ran backwards and forwards looking at it, and jumping up in a half-playful way. I got it for him and put it on the ground, but he would have none of it! He then ate some grass.

Obs. 282. *Sp.* 124.—*Rhynchium* sp.: while M. was examining something on a bush this wasp flew out: a black species with blue-black wings; the tip of the abdomen conspicuously white. It soon settled on the ground, and M. went to look at it. He pawed it violently on the ground and then left it.

Series Al. Obs. 283–285. *Jan.* 16.

Series Am. Obs. 286–289. *Jan.* 16.—About 10 a.m. I took M. out hunting, but he was not at all keen; I found when he got back he was extremely thirsty and perhaps had fever.

Obs. 286. *Sp.* —.—He ate two large *Cyrtacanthacris* grasshoppers.

Obs. 287. *Sp.* 127.—Lymantrid: while M. was on a bush something fell off a branch on to the ground among long grass. M. jumped down to see what it was, and picked it up, handled it, and dropped it. It was a dark caterpillar with short grey hairs.

After this a number of insects were eaten.

Series An. Obs. 290–303. *Jan.* 16.—At noon I tried M. with the following. He should have been hungry, but was not.

Obs. 290. *Sp.* 129.—*Sternocera boucardi* Saund.: an enormous beetle, greyish or greenish ground-colour, spotted conspicuously with yellow pubescence, found in numbers on slender twigs of small tree—very conspicuous both at rest and on wing. M. looked at it for a long while, walked round it, then tried biting it, but could make no impression on its hard and slippery surface. In some way it nipped him (probably his tongue got nipped between posterior edge of thorax and anterior edge of elytra, as with Sp. 43, Obs. 70) and he put it down hurriedly and began to paw it on the ground. After a while he took heart and began again, and at last bit off its head, but spat it out uneaten. Eventually he got the viscera exposed, and ate the beetle in much doubt, rejecting some pieces—it was obviously very hard work breaking it up.

Obs. 292. *Sp.* 131.—Chrysomelid: a cluster of larvae found on end of a twig, inhabiting a common web. The larva was about $\frac{1}{4}$ in. long, hairy, fat, and dull pink in colour, with median and lateral darker pink longitudinal stripes. I put the branch on the ground; M. walked round and round looking at the larvae, then tasted one, but did not eat it, and would have no more to do with the others—actually backing away when I held out the branch towards him.

(*Note.*—In this case the distasteful larvae gain very greatly by massing themselves together—for an individual is not extremely conspicuous.)

Series Ao. Obs. 304–314. *Jan.* 16.—At 5 p.m. I took M. out hunting: he was keen.

Obs. 304. *Sp.* 21.—Histerid, *Hister validus:* I found and offered this shining black beetle to M., who would have nothing to do with it.

Obs. 305. *Sp.* —.—He then found and ate a large grasshopper (*Cyrtacanthacris*).

Obs. 306. *Sp.* 58.—Acridiid, *Tanita* sp.: M. found a pair of these small grasshoppers in copula. The ♀ is green with integument roughened by papillae: the short tegmina do not entirely cover the imperfect red wings. M. ate them both slowly and hesitatingly.

Obs. 307. *Sp.* 42.—Coreid, *Anoplocnemis curvipes:* M. found one of these bugs on a bush and ate it in his usual hasty manner.

Obs. 308. *Sp.* 34.—Acridiid, *Humbe tenuicornis:* M. saw this grasshopper on a bush from a long way off and chased it, but it escaped.

Obs. 309. *Sp.* 58.—Acridiid, *Tanita* sp.: another pair found in copula. M. went for the larger ♀ first, but this time he only bit off the head and dropped the rest, which was kept for record. He then began to eat the ♂, but mouthed it a good deal and rejected some parts.

Obs. 310. *Sp.* —.—He then ate a large *Cyrtacanthacris* grasshopper, and some leaves.

Series Ap. Obs. 315–317. *Jan.* 17.

Series Aq. Obs. 318–328. *Jan.* 17.—M. very hungry.

Obs. 319. *Sp.* 144. Mantid: I offered M. a half-grown specimen of a large species; leaf-green with some white marks on the sides of the fat abdomen. M. looked at these marks with a little doubt before devouring the mantis with zest.

(*Note.*—It is interesting that M. took particular notice of these white marks which, when the insect is seen away from its surroundings, seem conspicuous. Doubtless among grass-stems the white marks aid concealment by breaking up the large area of uniform green.)

Obs. 322. *Sp.* 147.—*Papilio leonidas:* a blue and black tailless "swallowtail," mimicking the Danaine *M. petiverana.* M. held it a long time in his hand and looked at it very thoroughly, then, having tasted it gingerly, ate it without any sign of dislike.

(*Note.*—Though I had never offered him the Danaine model and he probably had never seen it, his behaviour was suggestive of an instinctive hesitation to eat a butterfly of this scheme of colour.)

Obs. 327. *Sp.* 152. Mutillid: a small species. Offered in a box with the next one. To my surprise M. took out and ate the Mutillid.

Obs. 328. *Sp.* 153. Cetoniid, *Leucocelis haemorrhoidalis* F.: a small beetle with elytra shining green, thorax black with two bright orange patches. Though M. was hungry enough to brave the sting of the Mutillid, he would not touch this beetle, which is abundant and exposes itself freely on flowers.

Series Ar. *Obs.* 329–337. *Jan.* 17.—In the evening I took M. out hunting.

Obs. 334. *Sp.* 46.—Tenebrionid, *Vieta* sp. ? *vestita*: M. found this procryptic, but bristly, beetle on a tree-stem near the ground, and took it, but at once dropped it.

(*Note.*—This beetle is an interesting example of how a procryptic insect can yet have means of defence when discovered. The fine bristles on the elytra aid concealment by holding dirt. It will have been noticed that in this observation, as well as in 68, the monkey disliked the feel of the beetle.)

Series As. *Obs.* 338–342. *Jan.* 18.—About twenty larvae taken from the mud nest of a large solitary wasp were greedily eaten by M. (*Obs.* 342. *Sp.* 161) after he had refused a large dull-black larva with orange head (probably Phytophagous). This tends to show that the wasp is not intrinsically distasteful.

Series At. *Obs.* 343–362. *Jan.* 18.—After a day's march M. was eager for insects.

Obs. 347. *Sp.* 7.—Meloid, *Mylabris tristigma* Gerst.: M. was very excited as he saw me bring something in my hand, but when I opened my hand and he saw this typically aposematic beetle inside he walked away!

Obs. 356. *Sp.* 170.—Pierid, *Mylothris agathina* ♂: a yellowish-white butterfly showing the typical "mud drinker's aposeme," viz. an orange-yellow flush at the base of the hind-wing beneath, and an orange border along the under-side of the anterior edge of the fore-wing. The hind-wing is bordered with black spots. M. was very eager to get this butterfly, but when he got it, held it in his hand and looked at it for a long while, then tasted its head. He afterwards ate the butterfly slowly with a lot of tasting and inspection.

Obs. 362. *Sp.* 176. Locustid [Tettigoniid], *Gymnoproctus* sp., immature: an absolutely wingless grasshopper with stout body and spiny thorax, greyish

with tint of green on thorax, a young specimen. It is by no means conspicuously coloured, but is of aposematic habit. An allied larger species (*Enyaliopsis*), much darker in colouring, is much disliked by the natives of Uganda, who say its bite makes sores. As a matter of fact, it readily exudes a yellowish acrid fluid.

I showed the *Gymnoproctus* to M. on my hand, but he would have nothing to do with it.

Series Au. Obs. 363. *Jan.* 21.

Obs. 363. *Sp.* 177.—Before M. had had anything to eat in the early morning I offered this Carabid, a species of *Tefflus*, a large dull-black ground-beetle. M. merely danced round it and would not touch it except to paw at it.

Series Av. Obs. 364–369. *Jan.* 21.—I took M. out hunting in the afternoon.

Obs. 364. *Sp.* 22.—Acridiid, *Dictyophorus productus*, Bol.: having eaten a lot of grass M. picked up this immature medium-sized grasshopper, almost wingless, with only rudiments of elytra, light yellow with longitudinal black stripes, typically aposematic, of very sluggish habits. He put it down undamaged.

Obs. 368. *Sp.* 179.—Scoliid, *Elis donaldsoni* Fox: to my great astonishment M., in front of a flowering bush, reached out and seized this Fossorial wasp, dull black with tip of abdomen dull red. M. ate it quickly.

Series Aw. Obs. 370–386. *Jan.* 21.

Obs. 384. *Sp.* 185. Lymantrid: the pupa of a very abundant white moth. It is shiny and bright yellow and clearly visible in the flimsiest of cocoons. The eyes and spiracles are shining black and very conspicuous; the sparse hairs rather long. I offered the cocoon to M., who ran away with it to examine it further. But it dropped as he went along (*N.B.*: desirable food would not be allowed to drop), and instead of picking it up, M. rubbed it very vigorously on the ground, as if it might bite or sting, and ate it very doubtfully.

Series Ax. Obs. 387–405. *Jan.* 23.—At 9 a.m., M. having had no insect food, but some banana—

Obs. 394. *Sp.* 153. Cetoniid, *Leucocelis haemorrhoidalis*: M. smelt this beetle, put it down with an

exclamation of disgust and walked away. The beetle emits a drop of foul-smelling fluid when handled.

Series Ay. *Obs.* 406–414. *Jan.* 23.

Series Az. *Obs.* 415–451. *Jan.* 24.—At 2 p.m. M. had had food but no insects, and squealed with excitement when he saw them coming.

Obs. 415. *Sp.* 117.—Carabid, *Harpalus* sp.: M. ate this black ground-beetle, *but rubbed his hands on the ground afterwards.*

(*Note.*—This very significant gesture shows how very distasteful was this beetle, which was only eaten under stress of hunger.)

Obs. 416. *Sp.* 86.—Lycid, *Chlamydolycus trabeatus:* this was actually tasted, but no more.

Obs. 417. *Sp.* 198. Lycid, *Merolycus femoralis*, Bourg.: M. pulled this beetle to pieces, tasted it, but ate none.

Obs. 418. *Sp.* 196.—Galerucid, *Diacantha* sp. nr. *conifera:* a bright yellow beetle with black tips to the elytra. This beetle was taken and dropped.

Obs. 419. *Sp.* 199.—Silphid, *Silpha micans* F.: a sea-green beetle found on an old giraffe skull. It was put on the ground and allowed to crawl within reach of M., who took it, bit it, and very decidedly put it down.

(*Note.*—That M. should bite such a very foul beetle shows how desirous he was for insect food, and makes his behaviour in *Obs.* 416–418 more emphatic. Later in this series, when he had eaten some insects, he refused a second *Silpha* with an exclamation of disgust!)

Obs. 420. *Sp.* 200.—Fulgorid, *Pyrops marginatus* Westw.: about an inch long, with a long snout, grey and speckled. I put it on the ground for M., who picked it up and bit off the "snout." Not finding it distasteful he put the whole insect into his mouth, but soon took it out, looked at it, pulled it about, and dropped it.

(*Note.*—This extremely procryptic insect was apparently quite distasteful.)

Obs. 421. *Sp.* 201.—Forficulid, *Forficula senegalensis* Serv.: an abundant medium-sized brown earwig with yellow tegmina. M. rubbed it very vigorously on the ground and would not taste it.

Obs. 422. *Sp.* 188. Eumolpid, *Euryope batesi*

Jac., ♀: a large, sluggish, bright orange beetle with black eyes and antennae. M. bit off the elytra, tasted the beetle, put it in his mouth, ejected it with an expression of disgust, but put it back and ate it reluctantly.

Obs. 447. *Sp.* 215.—Tenebrionid, *Catamerus revoili* Fairm.: a large, common, dull blue-black, sluggish beetle, much reminding one of the English "bloody-nose beetle," save that its elytra are rugose: it walks about like the other, and is as conspicuous. M. looked at it for a long while, took it and smelt it, and rubbed it furiously on the ground. I went to pick it up, but M., out of mischief, seized it and held it, but even then did not put it in his mouth.

(*Note.*—Between *Obs.* 422–447 M. had eaten a number of insects.)

Series Ba. *Obs.* 452–454. *Jan.* 25.

Series Bb. *Obs.* 455–470. *Jan.* 26.—At 7 a.m., M. having had as much vegetable food as he wanted—

Obs. 455. *Sp.* 218. Lycid, *Merolycus dentipes* Dalm., var. *flavoscapularis* Bourg.: typically aposematic, orange and black beetle. M. turned it over, pawed, smelt, and left it.

Obs. 456. *Sp.* 188. Eumolpid, *Euryope batesi*: M. would have liked to eat it, but couldn't face it: he licked and smelt it and finally dropped it.

Obs. 457. *Sp.* 54.—Galerucid, *Diacantha conifera*: pinkish-orange beetle with the end of the abdomen projecting beyond the black tips of the elytra. Several males and females found most conspicuously on low herbage. One was offered to M., who smelt it and threw it down.

Obs. 458. *Sp.* 220.—Tenebrionid, *Zophosis pterygomalis* Gebien: a flat, dull grey-black beetle, which runs about in hot sun very actively. Many were found under a stone. One was put on the ground for M., who smelt it, nibbled at it, pulled it to pieces, and put it down uneaten.

Series Bb. *Jan.* 26.

Obs. 459. *Sp.* 197.—Sagrid, *Sagra* sp., not in Br. Mus.: a large, dull blue-black beetle of sluggish habits; the hind femora are greatly thickened. M. looked at this beetle for a long while, not really wanting it, but being playful and mischievous, took it in his

hand and ran about with it. He then nibbled a leg off, looked again at the beetle, tasted it again, and finally put it in his mouth and ate it because another monkey, near by, wanted to see what he had got! I am quite sure he would not have eaten it had he been alone.

(*Note.*—It was remarked at the beginning of the paper how important it was to know the monkey, and that he should be undisturbed. An inexperienced observer might easily have concluded that the above beetle was far more edible than another observation (413) has shown it to be.)

Obs. 460. *Sp.* 221.—Curculionid, *Microcerus spiniger* Gerst.: a ground-weevil, large, black, with rugose elytra and short blunt rostrum. M. looked at it a long while before taking it; ran about with it as if challenging the other monkey to take it, then bit off the rostrum and ate the beetle with difficulty. It seemed very hard and M.'s attitude suggested that he was only eating it to spite the other monkey!

Obs. 461. *Sp.* 22.—Acridiid, *Dictyophorus productus:* M. looked long at this grasshopper as it crawled on the ground, then picked it up and ran about with it in play, then dropped it.

Obs. 462. *Sp.* 186.—*Five* of these Acridians (*Catantops decoratus* Gerst.) eaten eagerly. A medium-sized, procryptic, grey grasshopper used as staple food.

Obs. 463. *Sp.* 222.—Pyrrhocorid, *Roscius illustris* Gerst.: a large black bug, with red head, an orange spot on each side of the thorax, and two orange spots on each tegmen. Extremely conspicuous. M. looked at it, smelt it, bit off and ate its head, then ate the rest without definite sign of pleasure or dislike.

Obs. 464. *Sp.* 223.—*Bromophila caffra* Macq.: a very large and sluggish black fly with crimson head, extremely conspicuous at rest, or when flying, which it does slowly and heavily, being remarkably easy to catch. Any human would say, "What a disgusting-looking fly!" It was offered to M. in a box; he looked long at it, with his head on one side, took it out, and threw it down in disgust.

Obs. 465. *Sp.* 224.—Buprestid, *Agelia peteli* Gory: a large black beetle, with symmetrical pale greenish-white areas on the elytra and an orange mark on

each side of the thorax. A pair, in copula, found sitting conspicuously exposed, on a leaf of a bush. One was offered to M., who took and ate it without hesitation.

Obs. 466. *Sp.* 186.—*Catantops decoratus :* three staple grasshoppers eaten readily.

Obs. 467. *Sp.* 225.—Tenebrionid, *Rhytinota acuticollis* Fairm. : like 69 (Obs. 133), a smooth, black, polished beetle. Found under a stone, but others often seen running conspicuously in the sun. M. paid no attention to it crawling in front of him till I pushed it towards him, when he bit it in half, and hurriedly spat out the piece in his mouth.

Obs. 468. *Sp.* 226.—Lamiid beetle, of fair size, dull blue-black, spotted with buff, procryptic. Offered to M. on my fingers; he seemed to know the beetle from some distance away, ran up and seized it at once. He bit off its head, and ate it, then looked attentively at the body before eating it all.

Obs. 469. *Sp.* 186.—*Catantops decoratus :* three grasshoppers eaten, but not very hungrily.

Obs. 470. *Sp.* 227.—Blattid : a male cockroach of the usual light brown colour, was given M. in the afternoon. After a little hesitation he bit off its head, but did not seem to like it much, he merely pulled the body about and played with it.

Series Bc. *Obs.* 471–484. *Jan.* 27.—At 10 a.m. M. had had as much vegetable food as he wanted, but squealed with excitement when he saw me bring the insect boxes. So I gave distasteful species first—

Obs. 471. *Sp.* 215.—Tenebrionid, *Catamerus revoili :* M. looked long at it, turned away, looked again, picked it up and bit it. A droplet of yellow oily fluid came out from between thorax and abdomen, and M. at once dropped the beetle.

Obs. 472. *Sp.* 13.—Tenebrionid, *Macropoda transversalis :* when I put this beetle down, M. looked disappointedly at it for some time, then took it and ran about with it in play, put it in his mouth, crunched it a little, then took it out and put it down.

Obs. 473. *Sp.* 228.—Coreid, *Cletus ochraceus* H. S. : a small, brown, plant-feeding bug, procryptic. Put in mouth and rapidly eaten with face rather doubtful and expressive of dislike.

Obs. 474. *Sp.* 229.—Carabid: a small, black ground-beetle; several found together under a stone. M. rubbed it violently on the ground, picked it up, bit off its head, looked at it surprisedly, pulled it to pieces, smelt and tasted it, but ate none.

Obs. 475. *Sp.* 230.—Blattid, ♀: this cockroach, medium-sized, light brown, was found lying in the paralysed condition caused by a sting from a Fossor. Offered to M., who rubbed it on the ground, smelt it, pulled it to pieces, but ate none.

Obs. 476. *Sp.* 231.—Trogid, *Trox incultus* Boh.: a scavenging beetle, very sluggish, dull grey-black, with rugose elytra. When alarmed it tucks all its limbs close to its body, and looks like half a raisin! It is found under dried-up bits of hide, bones, stones, etc. I offered one to M., who very minutely examined it, pulled off a leg and tasted it, then nibbled and pulled it to pieces, but ate none.

Obs. 477. *Sp.* 232.—Blattid, ♀: a black cockroach, offered in a box; M. took it out, pulled it about, smelt it, and allowed it to run away.

Obs. 478. *Sp.* 233.—Melolonthid, *Schizonycha* sp.: a medium-sized, light brown chafer which came to light. M. pulled it about, and ate it very doubtfully.

Obs. 479. *Sp.* 117.—Carabid, *Harpalus* sp.: this beetle was violently rubbed on the ground, and then crunched up very quickly, seemingly less disliked than was No. 229 (Obs. 474), though obviously eaten only owing to hunger.

Obs. 480. *Sp.* 186.—Eight staple Acridians (*Catantops*) were then greedily eaten, with squeals of excitement.

Obs. 481. *Sp.* 93.—Nymphaline, *Precis cebrene:* this butterfly was eaten eagerly. M. then had a long drink.

Obs. 482. *Sp.* 234.—Zygaenid, *Neurosymploca xanthosoma* Jord.: a small moth, of uniform dull greenish-black colour, offered in a box. M. took it out, smelt it, pulled it into many pieces; tasted it, but ate none.

Obs. 483. *Sp.* 186.—One *Catantops* eagerly taken.

Obs. 484. *Sp.* 235.—Carabid, *Eccoptoptera cupricollis* Chaud.: a medium-sized ground-beetle, mimicking the general type of colouring of a *Mutilla*, like which also it ran. The head and thorax are dull red,

the pubescent elytra dull black with four large white spots. I allowed this mimetic beetle to run within reach of M., who appeared afraid of it, pawed it, and at once ran out of reach; this he did several times, and at last ate it very quickly with no sign of dislike.

(*Note.*—In a way this was disappointing, as I had hoped M. would leave it alone. Nevertheless he has eaten Mutillids on other occasions. The manner in which he ran out of reach after delivering his attack suggested very strongly that he was afraid of a sting from the Mutilloid insect: for although a Carabid of similar size would be pawed, M. would not run away from it. Moreover, had M. thought it was a Carabid beetle I believe he would *not* have eaten it at the end of a long experiment when he had had abundance of insect food. A point of considerable interest is that this mimetic beetle seems to have lost the extremely unpleasant acrid smell emitted by most members of its family—it could not be made to produce it by repeated interference, or even by pressing it down on to a hard surface. One is tempted to conclude that in the absence of its defensive weapon it has come to resemble the powerfully stinging aposematic *Mutilla*. Even the *Mutilla*, however, is tackled on occasion, and eaten by M. !)

Series Bd. Obs. 485–503. *Jan.* 27.—At 4 p.m., M. being ready for insects—

Obs. 493. *Sp.* 239.—Fulgorid, *Hypselometopum morosum* Westw.: a fairly large Homopterous species kicked up from low herbage; the tegmina speckled brown, very procryptic. The wings were tinted with rose, the abdomen whitish, waxy. I held it in my fingers so that the rosy wings could be seen. M. took it and looked at it for a very long time, pulled off one tegmen, put the insect into his mouth and closed his lips over it without biting it, pulled it out again, looked at it, pulled off the other tegmen and both wings, looked long at the waxy abdomen, and at length ate it very doubtfully.

Obs. 499. *Sp.* 244.—Cerambycid, *Anubis* (*Oligosmerus*) *limbalis* Har.: a small, slender, bright green Longicorn beetle with the long black antennæ tightly curled back at the tips. Like our "musk-beetle," it has a strongly aromatic, rather pleasing odour. I

have only seen the beetle feeding on the yellow flower-heads of a common Composite, where it is, of course, conspicuous, but among green foliage it might be concealed. When it was offered to M. he did not eat it at once, but took it and ran up to his perch, where he had a good look at it, then ate it with no sign of dislike.

Series Be. *Obs.* 504–510. *Jan.* 27.—I took M. out hunting, but he was not keen.

Obs. 510. *Sp.* 172.—Pierid, *Belenois mesentina:* as M. walked along he saw this white butterfly in the position of complete repose on a grass stem. He ran to it, pounced on it with both hands, and ate it with gusto.

(*Note.*—His manner of catching the butterfly strongly suggested an instinctive method of catching insects commonly eaten. He does not catch grasshoppers like that.)

Series Bf. *Obs.* 511–529. *Jan.* 28.—At 5 p.m. M. very hungry for insects, though he had had plenty of vegetable food.

Obs. 516. *Sp.* 250.—Tenebrionid, *Anchophthalmus clathratus* Gerst.: a dead black, flat beetle found under a log. I put it down for M., who looked at it and twice bent down to nibble it, drawing back each time with a little shake of his head as if it had bitten him, after which he left it alone. I found that this beetle stridulates by vigorous nodding movements, the "neck" rubbing against the thorax.

Obs. 529. *Sp.* 257.—Mutillid, *Dolichomutilla guineensis* F.: a large black species with two white spots at base of abdomen and two at apex. M. with great eagerness seized it out of the box and bundled it into his mouth, getting his hands and lips stung. He shook his head and ran about, and the Mutillid fell out of his mouth, but he picked it up and ate it greedily, though for a few minutes afterwards he ran about shaking his head and wiping his mouth with his paws.

(*Note.*—M. must have been very hungry, for after eating 14 grasshoppers and 5 other insects, and having been badly stung, he picked up the *Mutilla* again and ate it. I had no more insects left to test him with.)

Series Bg. Obs. 530–546. *Jan.* 29.—At 2 p.m., M. having had a good meal of vegetable food but no insects—

Obs. 533. *Sp.* 59.—Lagriid, *Lagria rhodesiana* Péring., a dull purplish, hairy, soft beetle that freely exposes itself on grass tips. I kept this in my closed hand, so that M. was inquisitive to see what was inside. When I opened my fist and he saw the very distasteful beetle his face fell and he would not touch it. But he took it as a joke, broke into a broad grin, and frolicked with my hand in a most amusing way.

Obs. 539. *Sp.* 260.—Buprestid, *Discoderes* sp., not in Br. Mus.: a highly procryptic beetle, of rather curious appearance, about half an inch long. Brown, with curious little knobs and excrescences. I found a pair in copula on a leaf, and did not recognise them as beetles at first; nor, apparently, did M. I offered one on my hand; M. looked at it and after a little hesitation took it, looked again at it, and put it in his mouth for a preliminary bite. This, however, made no impression on the hard beetle, and M. took it out for another look. After several more gentle bites had no effect M. bit harder, and finding it tasty, ate it with relish.

(*Note.*—It seems extremely likely that M. would have altogether passed the beetle by in its natural surroundings, owing to its procrypsis.)

Obs. 540. *Sp.* 261.—Curculionid, *Baris* sp.: a small long-snouted black weevil. M. ate it at once without hesitation.

Obs. 541. *Sp.* 262.—Zygaenid, *Neurosymploca xanthosoma* Jord.: a small dull black moth with bright yellow abdomen and a yellow spot on each side of the thorax. Very sluggish, and sits about on grass stems. A ♂ was offered to M., who pulled it to pieces, and put the yellow abdomen into his mouth, rolled it about and mouthed it a lot, but did not eat it with pleasure.

Obs. 542. *Sp.* 263.—Lamiid, *Spilotragus xanthus* Jord.: a small and delicately made Longicorn beetle, light grey and yellow. M. handled it gingerly and examined it well, bit off its head delicately, and ate the rest rather doubtfully.

(*Note.*—It seemed to me that the yellow markings in a slight degree gave this slender beetle a Hymeno-

pterous appearance, and from the careful way M. handled it at first, I think he was of the same opinion.)

Obs. 543. *Sp.* 262.—Zygaenid, *Neurosymploca xanthosoma:* M. pulled the wings off this moth, put the abdomen in his mouth, rolled it about, and pulled it out again.

Obs. 544. *Sp.* 264.—Pierid, *Eronia cleodora:* a large white butterfly with broad, irregular, black border; on the under-surface the wings in position of complete rest extraordinarily resemble a yellowish half-dead leaf. *At rest*, therefore, this butterfly is extremely procryptic, and I expected it to be eagerly eaten. I offered one to M., holding it gently by the body in my fingers, so that he could see it well. He leapt up and seized it, but instead of putting it straight into his mouth he sat looking at it for a long while, tasted it, pulled it about, and ate parts of it only, with doubt and much "mouthing."

(*Note:*—This butterfly makes the most of its procryptic under-surface by selecting for its sleeping-place some leaf, half dead, of the yellowish-green variegated colour with which the under-surface of the wings so well harmonises. In one locality where I collected the butterfly was not at all abundant, yet one evening, when passing a tall herb which had only a few big leaves, one of which was wilted, no less than three *E. cleodora* suddenly flew out, to my amazement, as I had no idea they were there. I watched one deliberately return and hang from the under-side of the wilted leaf, with which its colours so well harmonised. ("Essays on Evolution," pp. 283, 301.)

The fact that such an undoubtedly procryptic underside is not associated with a greater degree of edibility is interesting. Seeing that this butterfly is so unusually procryptic, and that its close ally *Catopsilia*, Obs. 360 and 577, Sp. 174, is shown to be also somewhat distasteful, that quality is perhaps associated with the particular group to which *cleodora* belongs, and it may be an exception among its relations in being markedly procryptic.)

Obs. 545. *Sp.* 212.—*Teracolus eris* Klug.: M. seized this Pierine butterfly quickly, and ate it, but not with great relish. A white species with broad black bar on f.w. and a bistre patch at the tip.

Obs. 546. *Sp.* 186.—Five staple Acridians (*Catantops decoratus*) eaten with zest.

Series Bh. *Obs.* 547–548. *Jan.* 29.

Series Bi. *Obs.* 549–563. *Feb.* 1.

Series Bj. *Obs.* 564–581. *Feb.* 2.—At 2 p.m., M. having had food, but no insects—

Obs. 570. *Sp.* 47.—Buprestid, *Agrilus discolor:* a pair of these beetles found in copula conspicuously exposed on a leaf. One was offered to M., who looked so long at it that I thought he was not going to take it. Suddenly, with decision, he took and bit it, and then ate it without further hesitation.

(*Note.*—The grey, black, and rose tints of this beetle and their arrangement somewhat remind one of the similar colours common among Hemiptera; and M.'s behaviour rather suggested that there may be a deceptive resemblance. If so, the mimicry is pseudaposematic, for the beetle was very edible.)

Series Bk. *Obs.* 582–586. *Feb.* 3.—At 2 p.m., having had some food, M. eager for insects. He refused a Cetoniid (*Diplognatha silicia*) and then ate 15 grasshoppers.

Obs. 585. *Sp.* 278.—Chrysidid: a medium-sized "fire-tail wasp" of the usual brilliant green, with blue tip to the abdomen. M. looked long at this, then took it and ate it, to my great surprise not getting stung.

(*Note.*—It is very likely that M. had not met one of these before—it will be noted that he looked at it a long time. These formidable, stinging insects are hard and highly conspicuous.)

Obs. 586. *Sp.* 279.—Galerucid, *Exosoma ugandaensis* Jac.: a small, gregarious, conspicuous beetle found on low herbage; head and thorax black, abdomen brown. It was smelt and dropped; I offered it again, with the same result.

Series Bl. *Obs.* 587–595. *Feb.* 4.—In afternoon, M. being eager for insects—

Obs. 590. *Sp.* 280.—Cassidid: a large "tortoise-beetle," fiery orange-pink spotted with black, and translucent. Very conspicuous on the wing. M. ignored it at first, then took and dropped it. Then, because I wanted to take it for record, M. ran off with it and pulled it to pieces, but ate none.

Series Bm. Obs. 596–611. *Feb.* 5.—At 1.30 p.m., M. had had food, but was very hungry for insects.

He ate 12 grasshoppers and some other insects, refusing others.

Obs. 606. *Sp.* 286 A.—*Danaida chrysippus:* the typically aposematic orange-brown butterfly with black wing tip enclosing a white bar. M. seized it very eagerly, then looked at it for a long time, pulled off the wings, and ate the body.

Obs. 607. *Sp.* 287.—Hypsid, *Argina amanda* Bd.: a medium-sized, bright orange moth speckled with black. The wings of one side were cut off and the moth put on the ground. M. looked well at this, put the body into his mouth, pulled it out, put it in and pulled it out again, and finally discarded it.

(*Note.*—His refusal of this aposematic moth is made more emphatic by his having been hungry enough to eat the distasteful *D. chrysippus.*)

Obs. 608. *Sp.* 170.—Pierid, *Mylothris agathina:* M. was not at all eager to take this butterfly from my fingers, but ate it without definite sign of dislike.

Obs. 609. *Sp.* 286 B.—*Danaida chrysippus*, form *dorippus* Klug: the variety without black-and-white wing tips. M. took it and pulled off the wings, then ran about with the body for some time before putting it into his mouth and eating it. After this two medium-sized and one large grasshopper were eaten.

Series Bn. Obs. 612–615. *Feb.* 5.—These were the last observations made with M., for his owner took him back.

SECTION II.

In this section an attempt will be made to diagnose the degree of edibility of each species used in the experiments (including those of which details are omitted), grouping the species in their proper genera and families.

I propose to use letters to denote the significance of the colours and habits of the insects, and the signs +, −, or ± to denote their edibility.

It must be constantly borne in mind here that I am only speaking of edibility *to the monkey which was used as the test:* to another animal, or a bird, the insects might be more, or less, edible.

Regarding the colours, they may be either aposematic, or procryptic, or of such a nature that one cannot class them in either category.

One had also to consider that there are insects which, from freely exposing themselves, appear to have what may be termed "aposematic habits," although such habits may not be associated with conspicuous colours.

Likewise there are insects whose colours do not seem especially to harmonise with their surroundings, yet their habits are like those of typically procryptic insects.

AA In this class I put the typically aposematic insects of bold and fearless manner, showing conspicuous colours freely exposed.

A Comprises the less conspicuous, but still conspicuous and exposed species.

a In this class are the insects which have aposematic habits, although their colouring does not make them conspicuous.

PP These are the typically procryptic insects, concealed by their extreme degree of resemblance to the colours, and often shape, of their immediate surroundings. Attitude often plays an important part in increasing the resemblance.

P Insects of self-effacing habits, concealed on the whole by dingy colours or a general resemblance to their surroundings.

p This class contains insects of retiring nature, whose colours cannot be said particularly to aid in their concealment.

C This letter implies that I do not see my way to putting the insect in any of the other groups, *i.e.* it is a confession of ignorance!

Regarding the edibility, I have made six categories.

++ This is the class of extremely edible species always eaten greedily, without hesitation, and with evidence of relish.

+· These insects are eaten with relish, but are first looked at for some time, or may be tasted.

± In this class come those species which are eaten doubtfully, or may be refused, after tasting, smelling, or pulling about. It must be remembered that this implies a certain degree of distastefulness.

— The qualifications for this class are that the insect undergoes repeated tasting, smelling, pulling about; may be pulled to pieces and examined and only eaten partially, or the whole may be put into the mouth and pulled out again. These insects are only eaten extremely doubtfully, or because of hunger.

—— In this class are put insects which are only tasted, and eaten with great reluctance only under pressure of great hunger.

——— These insects are never even tasted, and may be completely ignored.

○ This sign is used to surround any of the other signs, thus, ⊕ or ⊜. It implies that, on one occasion at least, the monkey has rubbed and pawed the insect on the ground as previously described in the introduction, and has subsequently dealt with it as indicated by the sign enclosed in the circle.

It will be noticed that if an insect escapes tasting it must be either highly edible, or highly distasteful!

ORTHOPTERA.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Forficulidae.			
201	421	*Forficula senegalensis* Serv.	C	⊜	Abundant, medium-sized, brown and yellow.
208	439, 550	*Anisolabis infelix* Burr.	C	⊜	Large, apterous, black.

General remarks on the FORFICULIDAE.

M. showed extreme dislike of, and I think fear of, these earwigs. I could detect no odour and concluded that the appearance of the forceps acted as deterrent. If earwigs were liked they would be a very easily obtained food, for they are usually abundant when present.

		Blattidae.			
79	161	?	C	++	There is doubt as to whether this *was* a Blattid.
126	285	?	C	———	A light yellow male.
227	470	?	C	———	A light brown male.
230	475	?	C	⊜	A light brown female.
232	477	Prob. a *Pseudoderopeltis* sp.	C	———	A black female.
266	549	?	C	——	A large, black female.
270	565	Larva	C	———	Small, yellow-brown.

General remarks on the Blattidae.

This monkey seemed to agree with the human estimate of cockroaches as disgusting insects! Obs. 161 is unique, and one is almost forced to believe it was *not* a cockroach that the monkey ate so eagerly. The notes omitted show that I did not see the insect until it was nearly consumed. The colours of the above Blattids do not fall into the scheme of classification adopted. The brightest-coloured light yellow species are just as timorous and light-shy as the darker species.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Mantidae.			
19	26, 92, 95, 165, 191, 243	*Idolum diabolicum* Saus.	PP	++	Large, green, with leaf-like expansions.
33	43	?	C	++	Very young, black, ant-like.
57	112	?	PP	++	Young, grey.
71	140	?	PP	++	Young of large species, slender, stick-like.
82	170, 173, 187, 247, 274	?	PP	++	Half-grown, brown.
128	288	?	PP	++	Small, brown species.
138	312	?	PP	++	,, ,, ,,
139	313	?	PP	++	Large, green species.
144	319		PP	+	Half-grown young of large species.

General remarks on the Mantidae.

All the above were extremely procryptic except the very young, No. 33; these small black specimens were somewhat ant-like. But when they are too large for this resemblance, Mantidae, so far as I am aware, are the most generally cryptic of any family of insects, and, young and old, were eaten with greed. Also the large and conspicuous white egg-capsules of No. 19 were eaten and sought out greedily. (See Series O, P, Q, X, Ab, Ac, Af, Ak.) Many Mantidae are known to take up a defensive or "terrifying" attitude when threatened, accompanied with a noise produced in a special way, and I was able to see this adopted on several occasions by No. 19, and on the first occasion it seemed to cause the monkey to leave the mantis alone. (See Obs. 26, 95, 194.)

		Phasmidae.			
81	168, 238, 278, 281	?	PP	++	

The *Stick* insects, most procryptic, were greedily eaten by M., as might be expected. It is noteworthy that on one occasion (Obs. 168) he seemed in some doubt as to whether a specimen *was* a living insect.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Acridiidae.			
5	7, 49, 217	*Zonocerus elegans* Thunb.	AA	− − −	Large, conspicuous, clumsy, black when young, when adult yellow and green with undeveloped wings.
16	23, 27, 160, 273, 308	*Phymatcus viridipes* Stål.	AA	− − −	Large, conspicuous, sluggish, blue, green and red, flies heavily showing purple wings.
17	24	*Tryxalid.*	PP	++	Large, green.
35	45	,,	PP	++	Large, green and brown; shows mauve wings when flying.
18	25, etc.	*Cyrtacanthacris ruficornis* Burm.	PP	++	Brownish, with grey and yellow marks. Used as staple food.
23	33, etc.	*Cyrtacanthacris cyanea* Stoll.	PP	++	No. 23 much larger, has purple wings.
22	32, 116, 186, 364, 461, 490, 532	*Dictyophorus productus* Bol.	AA	−−	Heavy-bodied, sluggish, aposematic, light yellow striped with black when younger, adults dark grey with undeveloped red wings.
34	44, 308, 345	*Humbe tenuicornis* Schaum.	PP	++	Earth-brown; yellow wings bordered with black.
58	113, 210, 272, 306, 309	*Tanita* sp., not in Br. Mus., and *T. semlikiana* Rehn.	PP	±	Small, earth-coloured; wings red.
91	193, 592	*Lamarckiana loboscelis* Schaum.	P.	±	Huge, apterous, earth-coloured female.
155	335	*Cardenius* sp., not in Br. Mus.	A	−	Short, stout, dull pinkish-brown, sides of abdomen red spotted.
186	387, etc.	*Catantops decoratus* Gerst., and *melanostictus* Schaum.	P	++	Used as staple food. Brown marked with yellow, black and greyish tints, very abundant among grass.
214	446	*Penichrotes* sp., ♀	A	±	Wingless, green with purplish - black abdominal bands. Rather "unpleasant looking." Found on tree.
	5	?	PP	++	
	8	?	P	++	
	13	?	P	++	
	17	?	P	++	
	50	?	PP	++	
	63	?	PP	++	
	71	?	P	++	
	91	?	P	++	
	107	?	PP	++	
	108	?	PP	++	
	110	?	PP	++	
	131	?	P	++	
	138	?	P	++	
	148	?	P	++	

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
	149	?	P	++	
	211	?	P	++	
	227	?	P	++	
	263	?	PP	++	
	264	?	P	++	
	276	?	P	++	
	279	?	P	++	
	296	?	P	++	
	330	?	P	++	
	346	?	P	++	
	351	?	P	++	
	366	?	P	—	No reason discoverable for this rejection.
	371	?	P	+	
	377	?	P	++	
	381	?	P	++	
	385	?	P	++	
	488	?	PP	++	
	507	?	P	++	
	523	?	PP	++	
	554	?	P	++	
	611	?	P	++	

General remarks on the ACRIDIIDAE.

The species of monkey used for these experiments eats great numbers of Acridiidae; I have often seen them hunting through long grass in the evenings, catching the grasshoppers which rose in front of them.

Three, or four, species (18, 23, 186) were used as "staple food," and many others were given to M. solely to eke out the less edible insects. It was not at first intended to list these, but I have done so; and as no particular note was taken of them they have not been given species numbers.

Seeing that the Acridiidae were with few exceptions procryptic, the more interest attaches to those that are not, viz. 5, 16, 22, 155, 214.

It is noteworthy that in these five species the wings are absent or undeveloped, or when present are brightly coloured and very materially aid in the aposematic effect: in the case of No. 16 the insect especially displays them when alarmed (Obs. 160). In 1915 I saw precisely the same use made of the wings by the same species when threatened by a fowl. The fowl ran up to the grasshopper, which remained apparently unconcerned until the fowl was close, when it raised the tegmina and wings vertically, spreading out the latter to show the brilliant tints. The fowl halted, gazed at the grasshopper, turned round and walked away. Another day a specimen was killed and laid on the ground, the coloured wings being concealed in the position of rest. Fowls pecked at it but obviously found it very tough, and though they pulled it about ate none of it.

In January 1919 I had another young monkey, probably of the same species as M., and offered it one day several Acridiidae. She seized two specimens of medium size, one in each hand, and bit off their heads. But the first one did not seem altogether pleasant to the taste, and she did not eat it; *its wings were tinted with carmine.* Before eating the second specimen she pulled apart the wing-covers and displayed its wings. In this species they were colourless, and the whole was eaten (cp. Obs. 272). Next day I gave her first of all another of the carmine-winged species. She took it rather hesitatingly, although she hadn't seen its wings, did not bite off its head but rather slowly bit off one leg, munched it, and then dropped the grasshopper.

Two other, larger, very favourite Acridiidae were then offered; one she let escape, the other, as I persuaded her, was at length taken and its head bitten off. It was eaten slowly at first, but with increasing satisfaction, for obviously she distrusted it at first after the experience of the carmine-winged specimen.

This question brings us to the coloration of the wings in other species which were not found to be distasteful, noted in Obs. 33, 44, 45, 113. The meaning has already been discussed in the note on Obs. 272; I believe that the interpretation of these cases is that the very obviously coloured wings serve to attract attention when the insect flies, and when it very suddenly drops the eye fixes the point where the colour was last seen.

But the insect is *not there*, having always crawled away to hide, when its procryptic tegmina cover the bright wings.

These coloured wings, however, may form a starting-point for the development of an aposematic scheme of colour as shown in species No. 16, which was found to use them aposematically in Obs. 160; and species No. 58 appears to be in a transitional stage. For though this species is procryptic, its wings appeared to be taken as an aposeme by the monkey, who certainly found the grasshopper somewhat distasteful (cp. also the 1919 observation).

It would appear that it is an advantage to the definitely aposematic species to lose the wings; in only two did they function as organs of flight (16 and 155).

A very interesting species is No. 91; a huge procryptic absolutely apterous female, which has been discussed in the note under Obs. 193. It appears to be slightly distasteful and its colour scheme is such that a mere change of shade, not pattern, might make it definitely aposematic.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Locustidae (Tettigonildae).			
176	362, 408	*Gymnoproctus* sp.	P	⊜	Absolutely wingless with spiny thorax, grey-green, very stout-bodied and sluggish, immature.
203	427, 429, 557	*Pantolepta heteromorpha* Karsch.	PP	±	Leaf-green, wingless, immature.
267	556	*Poecilogramma* sp.	A	−−	Blue-green with yellow markings, aposematic, apterous, immature ♀.
	265	?	PP	++	
	487	?	PP	±	(possibly same as 203.)
	557	?	PP	±	
	372	?	PP	+	Leaf-green.
	449	?	PP	++	,, ,,
	450	?	PP	++	,, ,,

General notes on the Locustidae (Tettigoniidae).

All of the above species were of the type with short fat bodies, all save one (176) of small size. Except for 176 and 267 they were bright green and extremely procryptic, but M. sometimes did not appear to eat them with much relish. In some cases the adult female is apterous.

It is of interest that another type of Locustid with long slender bodies, also green and sometimes brown, very procryptic, was always found extremely edible by my monkey on L. Victoria, who would eat them until his overfilled stomach rejected them! One specimen was identified as *Conocephaloides mandibularis* Charp. These Locustids are known to the Baganda as "Senene" and are esteemed by them as food. They often appear suddenly in long grass in large numbers.

		Gryllidae.			
248	501	*Gryllus* sp.	C	−	A large, black female.

This cricket, found by M., was half eaten, and discarded. Though monkeys may sometimes meet with crickets among dead leaves, etc., yet their nocturnal and burrowing habits render it unlikely that they serve as food to any extent.

NEUROPTERA.

		Termitidae.			
92	198, 267	?	C	+	A species which comes out of its holes in the ground and runs about even in the sun. It makes no hills.
		Hemerobiidae.			
213	415, 450	*Hagenomyia tristis* Walk.	C	±	

This Myrmeleonid had a smell somewhat like that of our lace-wing fly, and rather to my surprise it was eaten.

HYMENOPTERA.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Braconidae.			
245	500	?	AA	+	These three "Ichneumon-flies" were all typically aposematic, but were readily eaten one after another. Further experiments are needed.
246	501	?	AA	+	
247	502	?	AA	+	
		Apidae.			
125	284	*Apis mellifica* L., var. *adansoni* Latr.	A	⊜	Both these stinging insects were rubbed on the ground.
		Vespidae.			
124	282	*Rhynchium* sp., unnamed in Br. Mus.	AA	⊜	
		Formicidae.			
53	100, 249	*Megaponera foetens* F.	AA	− − −	M.'s fear of these powerfully stinging, large, black ants is shown by his leaping across a column on the march.
109	229	?	C	++	The winged adults of a small black ant which M. caught for himself in the air and ate.
	280	?	?	+	In neither case could I see the insect plainly.
	365	?	?	+	
		Chrysididae.			
278	585	?	AA	+	M. ate this and escaped being stung.
		Scoliidae.			
179	368	*Elis donaldsoni* Fox.	AA	+	M. ate this, which he found when hunting.
		Mutillidae.			The results with these aposematic, powerfully stinging insects seem contradictory. The first that M. ate stung him in spite of having been rubbed on the ground. Immediately afterwards he refused another species; the next one was absolutely refused; some time afterwards another was eaten readily, and again another which he persisted in eating in spite of having been stung, although he had just eaten a number of insects.
8	14	*Mutilla*, not in Br. Mus.	AA	⊕	
9	15	?	AA	− − −	
84	172, 174	*Mutilla*, not in Br. Mus.	AA	− − −	
152	327	?	AA	+	
257	529	*Dolichomutilla guineensis* F.	AA	+	
		Immature stages.			
161	342	Larvae and pupae of a large solitary wasp.		++	A large number eaten with relish, to repletion.
53	369, 383, 425	Cocoons of *Megaponera*.		++	Always eaten with relish.
111	241	Parasitic cocoons.	AA	− − −	A cluster of minute shining white cocoons was absolutely ignored.

General remarks on the HYMENOPTERA.

Monkeys are most likely to meet with ants and *Mutillidae*.

M. evidently recognises Hymenoptera as a group to be feared, for he rubbed several violently on the ground and took especial care to avoid *Megaponera*.

Yet I think that there is little evidence of their being actually *distasteful* in any of the observations; when the monkey did eat one he showed no signs of dislike, and even the three Braconids were eaten without hesitation, considerably to my surprise.

A point of considerable interest is that the larvae and pupae of the ant *Megaponera* were eaten with greatest relish. If the adults were inherently distasteful one would expect to find evidence of it in the *pupae* at least. One is inclined to think that Hymenoptera may be protected by their stinging power rather than by distastefulness.*

COLEOPTERA.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Lamellicornia. Scarabaeidea. Copridae.			
105	220	*Phalops laminifrons* Fairm.	A	⊜	Bright green.
130	291	?	C	– – –	Dull grey, one of the smallest "ball-rollers."
137	302	*Onthophagus* sp.	A	– – –	Dull black.

General remarks on the COPRIDAE.

They were all absolutely refused by the monkey, which is not surprising if their habits be considered. Many emit a foul odour when handled, their distasteful quality is not recognised by *all* observers, for I shot a roller in 1910 that had several large green Coprids in its crop and nothing else.

231	476	**Trogidae.** *Trox incultus* Boh.	P	– –	A dull grey beetle, found on old bones and skins. The remarks made on the Copridae apply to them also.
		Melolonthidae.			
114	251, 283	*Schizonycha* sp.	C	– –	Came to light. Both were light brown and I could see no reason why they should be refused.
233	478	*Schizonycha* sp. as above.	C	±	

* See, however, Trans. Ent. Soc. Lond., 1904, pp. 644–9.—E.B.P.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Cetoniidae.			
11	18	*Glycyphana balteata* Drury.	AA	⊜	An outlying member of the Lycoid colour-scheme.
134	297	?	A	− − −	Bright greenish-yellow.
140	314, 582	*Diplognatha silicia* Macl.	A	− − −	Polished black, or dull chocolate brown.
153	328, 379, 394	*Leucocelis haemorrhoidalis* F.	AA	− − −	Small and abundant, green.
194	400	*Rhabdotis sobrina* G. and P.	P	⊖	Inconspicuous.
237	491	*Pachnoda picturata* Boh.	AA	− − −	Yellow.
249	515	*Placsiorrhina trivittata* Sch.	AA	− −	Black with large whitish patches.

The Cetoniidae were universally condemned by M., being placed in the minus class without exception. The majority given were conspicuous, and they fly with a very loud noise. No. 153 was noticed to exude a drop of milky fluid when handled. No. 11 is somewhat synaposematic with the Lycidae.

		Hybosoridae.			
190	393, 401	*Phaeochrous* sp.	C	− − −	Dark brown, found on old bones.

General remarks on the Lamellicornia.

Broadly speaking, all the Lamellicorn beetles were much disliked by the monkey.

		Caraboidea. Cicindelidae.			
20	30	?	PP	⊕	Both these active, carnivorous beetles, procryptic, were eaten, though one was rubbed on the ground first, as if it were recognised as an insect that might bite.
163	348	?	P	+	

Remarks on the Cicindelidae.

Seeing that the Cicindelidae met with were inoffensive, and several species seemed to mimic the offensive Carabidae, it is interesting that the monkey found the two species offered to him decidedly edible.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Carabidae.			
15	22	*Anthia striatopunctata* Guér.	A	⊖⊖⊖	This powerful beetle so frightened M. that he ran away from it.
25	35	*Polyhirma* sp., not in Br. Mus.	A	⊜	Not a formidable species, but M. showed extreme dislike.
45	65	*Polyhirma calliaudi* Casteln.	A	⊖⊖⊖	Medium-sized, dull black, with white marks.
274	572	Probably same as 45.	A	⊕	Eaten I think to get rid of an unpleasant neighbour.
85	176	*Scarites superciliosus* Kl.	A	⊖⊖⊖	Flat, polished black, with powerful jaws.
269	561	*Scarites* sp.	A	⊖⊖⊖	Like 85. Both probably subterranean.
117	254, 415, 479	*Harpalus* or genus near.	C	⊕	Small, dark, retiring species. M. ate it on one occasion when hungry, but showed it was distasteful by rubbing his hands on the ground afterwards.
168	354	*Piezia* sp., not in Br. Mus.	A	⊖⊖⊖	Black, with dull white markings.
177	363	*Tefflus* sp.	A	⊜	A very large and formidable black species.
235	484	*Eccoptoptera cupricollis* Chaud.	AA	⊕	M. apparently at first mistook this for a *Mutilla* which it much resembles. This mimetic beetle seems to have lost the characteristic Carabid odour which perhaps explains why M. ate it without sign of dislike.
89	180	Like 117.	C	+	M. was very hungry for insects, as he had had none for several days.
149	324	?	A	+	Medium-sized, delicate, dull black, with brown pubescent markings on elytra.
166	352	?	A	⊜	Medium-sized, polished black.
229	474, 552	?	A	⊖	Small, black, found under stones.
100	212	Larva.	A	⊜	Thin and agile, polished black, but not formidable in appearance.

General remarks on the CARABIDAE.

This family of ground-beetles is very likely to be met with by monkeys when turning over dead leaves, sticks, stones, etc.; the species have a characteristic habit of ejecting from the tip of the abdomen a very ill-smelling or even acrid fluid, which in one case (Obs. 22) produced an unpleasant burning sensation on myself. In certain species (*e. g.* our English "bombardier") the fluid is so volatile that it produces a little puff of smoke with an

audible noise. The larger species have formidable jaws. It is therefore no matter for surprise that M. showed the strongest dislike to eight of the fourteen species offered him, and to three others a certain amount of dislike. Three others were eaten without evidence of distaste, but in one case there was stress of hunger; one of them was small and delicately made, and perhaps not odoriferous, while the other (235) was a mimic and had certainly lost the Carabid odour.

Besides this very close mimic I think that 25. 45, 168, are of a type of colouring approaching the Mutillid aposeme, though this did not strike me at the time. Dr. G. A. K. Marshall figures some of them in his paper on the bionomics of S. African insects (Trans. Ent. Soc. Lond., 1902, pp. 511–5, pl. xvii, figs. 1–20).

The contrast between the treatment allotted to Cicindelidae and to Carabidae is interesting, seeing that species of Cicindelids met with seemed sometimes to mimic Carabidae.

It is also worth noting that the polished black larva (Obs. 212) was treated as extremely distasteful. This may be compared with the remarks on the Hymenoptera in their immature stages.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Polymorpha.			
		Silphidae.			
199	419, 440	*Silpha micans* F.	A	−−	A sea-green beetle found on a giraffe skull.

Exactly the same remarks may be made of this and the following family as of the Copridae.

		Histeridae.			
21	31, 304	*Hister validus* Erichs.	A	⊜	Flat, smooth, polished black.
135	299	*Saprinus rasselas* Mars.	A	−−−	Greenish-black. Found under a bone.
136	300, 303	*Saprinus cruciatus* F.	AA	−−−	Bright orange elytra. Found with above.
		Coccinellidae.			
50	74, 121, 331, 559	*Alesia striata* F.	A	++	Pink and black. Common on grass tips.
98	207, 370, 410	*Epilachna chrysomelina* F.	A	++	Dull orange, black spots. Very abundant. Emitted acrid yellow fluid from joints when handled.
254	521, 526	*Epilachna paykulli* Muls.	A	±	Dull pink, black dots. Very abundant.
51	83	?	A	+	Bright pink and yellow with black marks. M. chose this for himself when out hunting.
88	179	?	AA	+	Shining black, two red spots. Emitted yellow fluid.

General remarks on the Coccinellidae.

The "ladybirds," for all their small size, appeared to be typically aposematic. These beetles with their bright colours, bold markings, habits of living freely exposed and of emitting acrid yellow fluid, might be expected to be condemned; yet M. ate several without sign of dislike and one quite eagerly. More experiments would be of interest.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Malacodermidae. Lycidae.			
10	16, 29	*Lycus constrictus* Fähr.	AA	– – –	
86	177, 181, 201, 230, 416	*Chlamydolycus trabeatus* Guér.	AA	– – –	In the ♂ the elytra enormously expanded.
198	417, 437	*Merolycus femoralis* Bourg.	AA	– – –	
218	455	*Merolycus dentipes* Dalm. var. *flavoscapularis* Bourg.	AA	– – –	
236	485	*Merolycus podagricus* Bourg.	AA	– – –	
?	367	?	AA	– – –	

General remarks on the Lycidae.

These beetles have a single scheme of colouring; orange or orange-brown with limbs black or black and orange, and tips of the elytra black. They have in a typical degree the habits of aposematic insects and freely and fearlessly expose themselves. Large numbers may be found congregated on a single flowering shrub. Dr. G. A. K. Marshall has drawn attention to the large number of insects of all classes that have been influenced by this predominant type, and several are dealt with in these experiments (Trans. Ent. Soc. Lond., 1902, pp. 515–8, pl. xviii, figs 1–52). The monkey put all the Lycidae in the most distasteful class. Twelve observations were made and only twice were these beetles tasted (Obs. 416, 417) under influence of hunger. Sp. No. 198 was tasted once and absolutely refused on the second occasion, when M. was less hungry. A rank odour was noted in Obs. 29.

		Lampyridae.			
49	73	*Luciola* sp., not in Br. Mus.	C	– – –	A light grey and dull yellow "firefly."
283	600	Larva.	A	– – –	Black and pink; like larval "glow-worm."

Remarks on Lampyridae.

It is to be expected that fireflies and glow-worms are distasteful, or else they would soon be destroyed by bats. The distastefulness of the larva is interesting.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Melyridae.			
63	123, 132, 506, 551	Genus near *Prionocerus* sp. with pattern of P. *dimidiatus*, but not in Br. Mus.	AA	− − −	A Lycoid species very abundant and conspicuous on grass tops. Emits yellow oil when handled.
		Elateridae.			
27	37	?	P	+	A dark brown species that came to light.
		Buprestidae.			
43	62, 67, 70, 101, 151, 169, 386	*Sternocera pulchra* Waterh.	A	±	A large blue-green species with orange pubescence: quite conspicuous, flies with loud hum.
129	290	*Sternocera boucardi* Saund.	A	−	Extremely conspicuous: the largest species offered. Grey-green, spotted with yellow pubescence.
47	69, 570	*Agrilus discolor* Fåhr.	A	±	Brightly coloured; rather like a common scheme of colouring in Hemiptera.
240	494	*Agrilus beryllinus* Fåhr.	PP	++	Small, bright green.
95	203	*Sphenoptera* sp.	P	+	Small, dull purplish-brown.
242	497, 593	*Sphenoptera disjuncta* Fåhr.	P	++	Dull bronze; sits rather close on twigs; quick to take alarm.
164	349	*Acmoeodera* sp., not in Br. Mus.	C	+	Small, greenish-yellow, black markings.
183	378, 566, 605	*Steraspis* sp., not in Br. Mus.	*a*	++ ++	Dull bronze; freely exposed on foliage.
224	465, 573	*Agelia peteli* Gory.	AA	++	Extremely conspicuous on foliage; large, black, with greenish-white and orange blotches.
260	539	*Discoderes* sp., not in Br. Mus.	PP	++	See description—a peculiar species.

General remarks on the BUPRESTIDAE.

From the point of view of the present paper this family is rather puzzling. On the whole these beetles are considered as edible; but the monkey seemed to find them very hard.

Sp. No. 43 was not eaten with zest at first, and the successive observations show that when the monkey had learnt to break up the beetle it was eaten readily. This, and the other large species, No. 129, appear to have a means of defence by pinching between the posterior edge of the dorsum of the thorax and anterior edge of the elytra.

When the beetle is handled this gap is opened widely (Obs. 62), and the monkey on one occasion got his tongue severely pinched (Obs. 70).

The larger species fly with a loud buzz and are extremely conspicuous on the wing. The undoubted hardness of the Buprestidae may be the quality with which their aposematic colours are associated, for they do not seem to be actually distasteful.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Heteromera. **Tenebrionidae.**			
13	20, 134, 228, 472	*Macropoda transversalis* Kolbe.	A	±	Rotund, large, black, very active beetles, which run about freely and may often be seen feeding on dead grasshoppers, etc.
24	34, 145	*Physophrynus*, sp. n.	A	(=)	
36	53, 375	*Lamprobothris fossulata* Müll.	*a*	−−	Dull purple shagreen, small.
46	68, 334	*Vieta* sp. ? *vestita* Gory.	P	(≡)	Light earth-brown; fine upstanding bristles on elytra.
69	133, 558	*Rhytinota gracilis* Gerst.	A	±	Smooth, polished black.
225	467	*Rhytinota acuticollis* Fairm.	A	−−	,, ,, ,,
167	353, 452	*Anomalipus heraldicus* Gerst.	*a*	−−−	Large, grey, flat, sluggish.
182	376, 496	*Praogena splendens* Mäkl.	A	−−−	Dull purple: freely exposed.
192	396, 516, 575	*Anchophthalmus clathratus* Gerst.	C	(=)	Grey or black, like a Silphid in shape.
215	447, 471, 531	*Catamerus revoili* Fairm.	AA	(=)	Large, dull blue-black, sluggish.
220	458	*Zophosis pterygomalis* Gebien.	C	−−	A flat grey species running about actively.
289	614	?	C	±	Like a large ground-weevil, dark grey. [Fragmentary: may be a weevil:]
156	336	Larvae, possibly of 215.	A	−	Gregarious, freely exposed on twig, blue-black.

General remarks on the TENEBRIONIDAE.

The beetles of this family, unattractive and of sombre hue, are often likely to be met with on the ground by monkeys, and some are extremely common.

Not one of the twelve species given to M. was regarded as really edible, and only three were eaten with great doubt.

It is also interesting to note that the larvae of one species were rejected.

		Lagriidae.			
59	114, 209, 513, 533	*Lagria rhodesiana* Péring.	*a*	−−	A dull, purplish-brown, small beetle, very common on grass tops.
		Meloidae.			
6	11, 111, 156, 271	*Coryna dorsalis* Gerst.	AA	−−−	Black with yellow marks.
7	12, 317	*Mylabris tristigma* Gerst., var.	AA	−−−	Black and orange.
241	495	*Mylabris amplectans* Gerst.	AA	−−−	Black and orange.
32	42	*Cyaneolytta coelestina* Haag.	AA	(−)	Like an "oil-beetle," dull purple.

Remarks on the MELOIDAE.

These beetles fulfil all the canons of typically aposematic insects; they were found feeding freely exposed on flower petals, except No. 32, which, having no wings, has only

been seen crawling on the ground like our English "oil-beetle." The others fly with a sonorous buzz. M. put them all in the most distasteful class, and on the only occasion when he bit one was in a frolicsome mood and had no idea of eating it; he made wry faces afterwards (Obs. 42). On only one occasion did he seem even to notice these common and very conspicuous beetles when out hunting (Obs. 271).

The quality which protects these beetles, which seem to come very near absolute inedibility, is brought to its highest perfection in the "oil-beetles" and allied Cantharidae or blister-beetles.

It is seen that the Heteromera given to or encountered by the monkey were all of them regarded as distasteful.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Phytophaga.			
		Sagridae.			
197	413, 459	*Sagra* sp., not in Br. Mus.	AA	− − −	A large dull, blue-black species.
		Megalopidae.			
195	407, 509, 588	*Poecilomorpha apicata* Fairm.	AA	− − −	A "Lycoid" species.
		Clytridae.			
2	2, 4, 48, 52, 124	*Clytra wahlbergi* Lac.	AA	− − −	Black and scarlet.
271	567	*Tituboca sansibarica* Lefevr.	A	−	Yellow-brown, four black dots.
272	568	*Diapromorpha*(*Peploptera*) sp. nr. *curvilinea* Jac.	*a*	− − −	Greenish-brown, black lines.
		Cryptocephalidae.			
72	141	?	AA	±	Black and scarlet.
116	253	*Cryptocephalus* sp., not in Br. Mus.	A	− −	Black and lemon yellow.
		Eumolpidae.			
12	19	*Pseudocolaspis* sp.	C	±	Dull bronze, pubescent.
150	325, 411	*Colasposoma* sp.	*a*	+	Dull bronze, rounded, freely exposing itself.
188	389, 402, 422, 456, 486, 617	*Euryope batesi* Jac.	AA	⊖	Bright orange with black limbs; extremely common and conspicuous.
193	397, 514, 612	*Corynodes usambicus* Klb.	A	±	Bronze green, thorax tinted with purple.
216	453, 511, 589, 616	*Corynodes raffrayi* Lefevr.	AA	⊜	Very like 188, but dull red rather than orange.
		Chrysomelidae.			
48	72, 208, 214,	Prob. a *Lygaria*, not in Br. Mus.	A	±	Pink and black, rather like a ladybird.
217	454	*Chrysomela* sp.	*a*	− − −	Round, dull bronze, exposes itself freely.
		Halticidae.			
3	3, 10, 155	*Physodactyla gerstaeckeri* Jac.	AA	− −	Orange, with black limbs, like 188.
76	152	Prob. *Blepharida* sp., not in Br. Mus.	P	±	Speckled brown and grey.
14	21, 51, 78	*Polyclada* (*Diamphidia*) sp., not in Br. Mus.	AA	±	Orange head and thorax, black elytra.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
258	530, 597	*Diamphidia* sp. nr. *femoralis* Gerst.	AA	— —	Orange with black limbs, like 188. Rather shy.
		Galerucidae.			
37	54	*Megalognatha* sp.	AA	— — —	Small, black and light brown; pregnant female has the swollen abdomen bright yellow.
54	102, 202, 457, 535	*Diacantha conifera* Fairm.	AA	— — —	Orange and black like a Lycid.
196	409, 418	*Diacantha* sp. nr. *conifera*.	AA	— — —	Like above but paler yellow.
180	374	*Diacantha petersi* Bertol.	A	— — —	Gravid female with swollen orange abdomen and green elytra.
77	153	*Ootheca mutabilis* Sahlb.	A	—	Orange thorax, blue elytra.
279	586	*Exosoma ugandaensis* Jac.	A	— — —	Small brown and black, gregarious.
		Cassididae.			
1	1, 9, 154	*Cassida* sp.	AA	— —	Orange with black spots.
38	55, 59, 426, 434, 512	*Aspidomorpha hybrida* Boh.	A	— —	Bronzy-green.
251	517	*Aspidomorpha quadrimaculata* Oliv.	A	— — —	Tinted with pink, and with small black spots.
284	601	*Aspidomorpha praecox* Boh.	A	— — —	Dull crimson with black pattern.
280	590	?	A	— — —	Fiery orange-pink, spotted with black.
		Family unknown.			
131	292	Larva.	AA	— —	Dull pink, feeding gregariously on a web.
160	341	Larva.	AA	—	Large, dull black with orange head.

General remarks on the Chrysomelidae *and their allies.*

Thirty-one species were offered, including two larvae, and all save one were treated as more or less distasteful. Almost all of them were aposematic, and specimens of sundry families formed synaposematic groups, *e. g.* No. 2 (Clytridae) and No. 72 (Cryptocephalidae) were black and scarlet; Nos. 188 and 216 (Eumolpidae), Nos. 3 and 258 (Halticidae) were orange with black limbs; No. 195 (Megalopidae), No. 54 (Galerucidae) were of the Lycoid type of coloration; and one Chrysomelid (No. 48) was very like a "ladybird." The sole Sagrid tested was much like our English "bloody-nosed beetle" in general appearance, habits, and conspicuousness.

It is of interest that two species of larvae, both aposematic, were also classed as distasteful.

The Cassididae are particularly interesting, for some, such as our English common green species, must undoubtedly be classed as procryptic, yet the monkey had no doubt about the distastefulness of five species offered him on eleven occasions.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Cerambycidae.			
244	499, 598, 603	*Anubis* (*Oligosmerus*) *limbalis* Har.	C	+	Small, bright green, with fragrant smell.
		Lamiidae.			
52	98, 99	*Dirphya similis* Gah.	AA	−	Black and orange, slender, Braconoid.
75	147, 343, 390	*Phantasis zanzibarica* Gerst., or closely allied sp.	*a*	±	Of very unusual form and habits; dull black; probably mimetic of the hard weevil No. 74.
226	468	?	P	+	Dull blue-black, spotted with buff.
255	524	?	PP	++	Bark-brown with two whitish blotches.
259	538	?	PP	+	Grey.
263	512	*Spilotragus xanthus* Jord.	C	+	Small, light grey and yellow: Possibly somewhat Hymenopteroid.

General remarks on the LONGICORNS.

These beetles are extremely likely to be met with by monkeys, and in one case (Obs. 468) the monkey seemed clearly to recognise the edibility of the beetle from a distance. A large species of Lamiid mimicking a common type of Braconid was definitely classed as distasteful.

The very abnormal species 75 seemed to me definitely to be mimicking a large and very hard ground-weevil found almost at the same time and place on the same day; it has only been found walking slowly on the ground. The only Cerambycid tested was a very abundant bright green species with characteristic odour, but I was unable to class its coloration. When found on yellow composite flowers it was very conspicuous, yet among green foliage it must be well concealed; its behaviour, however, is not that of a typically procryptic insect.

Every one of the species offered stridulated by strong nutation of the thorax except No. 75, but the monkey seemed to take no notice of this save in Obs. 98.

		Curculionidae.			
66	127	*Apoderus balteatus* Pér., var.	C	++	Yellow with pink elytra; perhaps resembles a leaf-gall.
68	130	*Microcerus* sp. nr. *annuliger* Har.	PP	++	Stone-colour.
221	460, 562	*Microcerus spiniger* Gerst.	C	±	Black, very hard.
96	205	*Attelabus pustula* Anc.	PP	+	Resembles red leaf-gall.
165	350	*Larinus* sp.	PP	++	Soft browns and greens.
202	423	*Alcides leucogrammus* Er.	PP	++	Striped longitudinally dark and light.
97	206, 257, 268, 492	*Isaniris* sp., probably new.	P	++	Black, speckled with whitish.
252	518	*Blosyrus haroldi* Hartm.	PP	++	Stone-colour.
253	519, 613	*Lixus* sp.	P	++	Large, covered with yellow bloom.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
261	540	*Baris* sp.	*p*	++	Small, black.
281	594	*Alcides* sp.	PP	++	Dark bark-brown.
26	36	?	PP	++	A ground-weevil of earthy colour, hard, rugose.
74	146	?	*a*	±	Very large, dull grey, sluggish, very hard.
146	321, 332	?	P	++	Black, speckled with whitish.
204	432	?	PP	++	Soft browns and greens.
285	604	?	PP	++	Light grey with longitudinal dark stripes.

General remarks on the CURCULIONIDAE.

These beetles appear to be eminently edible, and procryptic. Only two species were treated at all doubtfully and both appeared to be very hard; one of them (74) seems to be a model for the abnormal Longicorn 75. (See Obs. 147.)

It is hardly possible to get a more interesting contrast than that between the weevils and the group of Chrysomelidae and the allied Phytophaga.

The weevils are P and +, the latter A and —. The table in Section III of this paper shows this very graphically. Yet both are vegetarian and have similar habits in the adult state. It was particularly interesting in the field to find side by side on the same plants the Eumolpid 188 (AA —) and the weevil 253 (P ++), one relying for protection upon advertisement, the other upon concealment.

		LEPIDOPTERA.			
		Danaidae			
286A	606	*Danaida chrysippus* L.	AA	±	Orange-brown with black-and-white tip.
286B	609	Do. form *dorippus* Klug.	A	±	All orange-brown.
		Satyridae.			
107	223	*Neocoenyra* prob. *gregorii* Butl.	P	+	Brown, with reddish "Eye-spots."
		Acraeidae.			
104	219, 225, 317	*Acraea caldarena* Hew., f. *neluska* Oberth.	AA	— —	For an *Acraea* this is wary and difficult to catch.
141	315	*Acraea neobule* Dbl.	AA	—	Both these are thinly scaled, black and pink.
		Nymphalidae.			
80	163	*Precis clelia*.	P	?	M. took no notice of this when hunting; if he *did* perceive it, it should be in — — — class.
93	199, 293, 481	*Precis cebrene* Trim.	P	++	Large orange blotches on dark ground.
151	326	*Precis sesamus* ⊗.	A	+	This wet-season salmon pink form is held by Prof. Poulton to be synaposematic.
171	357	*Precis antilope* Feisth. ⊗ = *simia* Wallgrn.	A	+	Closely resembles the above.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
173	359	*Precis natalica* Feld.	P	++	Black and brown.
113	250	*Hypolimnas misippus* L., ♂.	A	?	M. when out hunting made no effort to catch this, which was sitting on the ground.
120	260	*Hypolimnas misippus* L., ♀.	AA	±	Mimics 286A.
211	443	,, ,, *misippus* L., ♀ f. *inaria*.	A	±	Mimics 286B.
169	355	*Neptis agatha* Cram.	A	+	Conspicuous black and white.

General remarks on the NYMPHALIDAE.

For the purposes of this article the coloration classified is that of the *under-side*, which is of most importance, since it is all that shows when the butterfly is in the condition of complete rest. Thus many *Precis* are brightly coloured above, but very procryptic below. It is interesting that the *Acraea* seemed more distasteful than *Danaida chrysippus*, and that *Hypolimnas misippus*, synaposematic with the latter, was put at about the same level.

Precis sesamus and *P. antilope*, the wet-season aposematic forms, were not treated as distasteful.

		Lycaenidae.		
62	119	*Axiocerces harpax* F.	PP	++

I have not offered Lycaenids to the monkey because their very small size makes them hardly worth while; their edibility to *birds* is another matter. But the above species (upper surface richly copper-coloured, under surface russet-brown) is of some especial interest, owing to the fact that the curiously twisted " tails " on the hind-wing aid very greatly in the procrypsis when the butterfly is in the position of complete rest for the night. The following quotation from an entry in my journal of January 13th, 1917, illustrates this : " Several species of Lycaenids were seen disposed for the night on shrubs, among them No. 62, which is very common here; this was a ♀. Both antennae projected straight out in front just above the surface of the leaf on which the butterfly sat. The fore-wings were completely covered by the hind-wings except for their extreme tips; the third silver spot on the costa (counting from the tip) being half covered by the hind-wing, and half exposed. The tails on the hind-wings projected almost vertically (in a line almost directly above the base of the abdomen, the whole of which was exposed) and

were not close together. After I had seen this specimen at rest I twice thought that bits of twisted dead leaves on other bushes were butterflies of this species." I may add that when the Lycaenid is flitting about and settles temporarily this attitude is not adopted; the tails then project backwards, and the antennae upwards as is usual.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Pieridae.			
103	218	*Terias senegalensis* Boisd.	P	+	Greenish-yellow.
106	221	*Teracolus eragore* Klug., f. *antigone* Boisd.	P	+	Orange-tipped above; below often suffused with pinkish or brownish scales.
108	224	*Teracolus achine* Cram.	P	+	
132	294	*Teracolus vesta* Reiche.	P	+	Yellowish-white, black tips.
212	444, 545	*Teracolus cris* Klug.	P	++	White, black bar on f.w. and bistre tip.
170	356, 580, 608	*Mylothris agathina* Cram.	A	±	Bright orange-yellow with red "flush."
142	316, 442	*Pinacopteryx simana* Hopff.	P	++	White, suffused beneath with grey scales.
172	358, 510, 578	*Belenois mesentina* Cram.	P	++	Black and white above; beneath chequered black and white with yellowish ground tint.
174	360, 577	*Catopsilia florella* Fabr.	P	±	Greenish-white.
264	544, 579	*Eronia cleodora* Hübn.	PP	±	See Obs. 544 for description.

General remarks on the Pieridae.

On the whole the monkey seemed to find them not unpleasant, but was rather doubtful about No. 170, the only aposematic species offered. The same doubt was manifested towards the most procryptic of all (No. 264) and its near relation 174. It must be remembered that, as with other butterflies, the classification of their coloration is founded upon the *under* surfaces of the wings.

No. 170 is very conspicuous on the wing, and when the butterfly is drinking from mud the orange-red flush at base of hind-wing offers an easily recognisable mark; the "mud-drinker's aposeme."

The apparent slight distastefulness of the highly procryptic 264 is rather unexpected.

The Pierines generally become much more procryptic in the dry season, when the under surface acquires a suffusion with pinkish, brown, or grey scales, causing them to harmonise admirably with the tints of the dried grass among which they settle.

Sp. No.	Obs. No	Name.	Colour.	Edibility.	Remarks.
		Papilionidae			
121	262	*Papilio angolanus* Gocze.	A	+	Black and white with good deal of red at base.
147	322	*Papilio leonidas* F.	AA	+	Mimetic of *Melinda petiverana* Dbl.-Hew.
		Hesperidae.			
4	6	?	P	++	One of the small black-and-white species.
29	39	*Rhopalocampta forestan* Cr.	C	+	The large white patch on the under-side of the dusky wings makes it uncertain how to classify this butterfly.
265	547	*Cyclopides willemi* Wallgrn.	P	+	Frequents long grass; marked with radiating streaks.
		Heterocera.			
		Zygaenidae.			
234	482	*Neurosymploca xanthosoma* Jord.	A	−−	A dull greenish-black species. See below.
262	541, 543, 574	*Neurosymploca xanthosoma* Jord.	AA	−−−	Black, with bright yellow abdomen which particularly attracted M.'s attention.
		Agaristidae.			
209	441	*Xanthospilopteryx superba* Butl.	AA	±	Black, crimson, and dull yellow; flight typically aposematic.
		Hypsidae.			
287	607	*Argina amanda* Bd.	AA	−	Bright orange speckled with black.
		Notodontidae.			
184	382, 414	*Anaphe ambrizia* Butl.	AA	±	Creamy white with coarse brown pattern. Sits freely exposed on leaves.
		Noctuidae.			
122	275	?	C	+	Large dark brown moth with conspicuous pale eye-like markings. M. endeavoured to catch this when hunting.

General remarks on the Moths.

All the aposematic species were treated as distasteful. The Hypsid was adjudged more distasteful than *D. chrysippus*, which is of interest since some of the moths of this family enter into synaposematic relations with other species of Lepidoptera.

Lepidoptera—(*continued*).

Larvae.

		Sphingidae.			
60	115	*Deilephila ?*	P	++	An apple-green larva (see Note, Obs. 115).
		Saturnidae.			
83	171	?	AA	−−−	Large, conspicuous larva armed with stout spines.
110	235	?	AA	−−−	
		Lasiocampidae.			
175	361	?	A	−−−	Yellow with black dots.
		Arctiidae.			
112	246	?	A	−−−	Clothed with dense very long black hairs.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Lymantridae.			
127	287	?	A	− − −	Dark, with short grey hairs, very irritating.
185	384, 412, 424, 433	Pupa ? sp.	AA	±	See note on Obs. 384.
		Psychidae.			
154	333	?	?	− − −	It was always a surprise to me that M. never made any attempt to break open the Psychid larva-case.
		Geometridae.			
90	184	?	A	±	Black.
256	528	?	PP	+	Colour of a dried grass stem.
—	90	**? Family.**	A	− − −	

General remarks on the Caterpillars.

From the way in which M. actually devoured 60 and 256, I do not think caterpillars can be much eaten by monkeys—they are too soft and "squashy." The monkey likes insects he can crunch up.

Diptera.

		Tabanidae.			
158	339	*Haematopota* sp.	C	+	
159	340				
		Asilidae.			
67	129	*Hoplistomerus serripes* F.	A	− − −	Mimetic of Hymenoptera perhaps a Scoliid.
73	142	?	C	+	
		Syrphidae.			
61	117, 216, 259	*Eristalis tenax* L.	A	− − −	The common "drone-fly" mimicking the Honey-Bee.
		Muscidae.			
157	338	*Glossina morsitans* Westw.	C	+	The "tse-tse" fly.
		Tachinidae.			
30	40	*Chromatophania distinguenda* Vill.	A	− − −	Conspicuous brown and pink hairy fly.
		Ortalidae.			
223	464, 548, 553	*Bromophila caffra* Macq.	AA	− −	Large black fly with coral-red head; very conspicuous.

General remarks on Diptera.

Flies are not likely to form the food of monkeys to any great extent. Obs. 338, 339, 340 show that M. caught and ate biting flies, but I think this was probably a means of disposal of unwelcome neighbours.

The cases of the mimetic species 67 and 61 show that M. was deceived by resemblance to Hymenoptera; he did not refuse a non-mimetic Asilid. Nos. 30 and 223, both conspicuous, were refused; and the monkey evidently agreed with me that the *Bromophila* was a disgusting-looking insect!

Hemiptera.

Heteroptera.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Pentatomidae.			
41	58, 204, 252	*Callidea bohemani* Stål.	AA	— —	Brilliant green and gold.
44	64, 182, 380	*Aspongopus viduatus* F.	A	— —	Large, brown and black.
55	103, 137, 498	*Agonoscelis puberula* Stål.	P	— —	Small, dull, inconspicuous.
123	277	*Agonoscelis versicolor* F.	P	— — —	Small, grey, speckled yellow, inconspicuous.
148	323	*Sphaerocoris testudogrisea* De G., var. *pardalina* Schm.	AA	— — —	Like a *Coccinella*, malodorous, orange with black spots.
206	436	?	A	+	Larva; blue; possibly same as 41, noted as malodorous.
40	57	?	P	±	Larva; grey, bark-like.
187	388	?	A	±	Larva; black, with orange spots; found congregated together.

Remarks on the Pentatomidae.

Except for one larva these bugs were definitely classed as very distasteful, though two species at least were procryptic. They are strongly malodorous.

		Coreidae.			
42	61, 77, 109, 125, 135, 144, 150, 157, 226, 261, 270, 307, 320, 571,	*Anoplocnemis curvipes* F.	A	⊕	Large, blackish-brown, very common.
228	473	*Cletus ochraceus* H. S.	P	±	Small, brown, inconspicuous.
133	295, 298	?	P	+	Larva; very alert, slipping round the stem of the plant to escape notice.

Remarks on the Coreidae.

No. 42, though very malodorous, was regarded as quite a dainty, although the monkey was obviously afraid of its proboscis and often rubbed it on the ground.*

* *A. curvipes* was also eaten greedily by Dr. G. A. K. Marshall's baboons, although rejected after trial by a kestrel (Trans. Ent. Soc. Lond., 1902, pp. 345, 382-3).—E.B.P.

Sp. No.	Obs. No.	Name.	Colour.	Edibility.	Remarks.
		Lygaeidae.			
65	126, 128	*Lygaeus* sp., not in Br. Mus.	AA	−−	Black and red.
189	391, 399, 101	Probably same as 65.	AA	+	Larvae; black and orange, congregated.
101	213	*Lygaeus militaris* F.	AA	(±)	Rose and grey.
191	395, 403	*Lygaeus festivus* Thunb.	AA	(±)	Black and rose.
87	178, 615	*Oncopeltus famelicus* F.	AA	−	Black and orange larvae, congregated.

Remarks on the Lygaeidae.

All the species tested were aposematic and treated as distasteful. But it is curious that the congregated larvae of No. 65 (189) were apparently not distasteful, though the larvae of 87 were unpalatable (Obs. 615).

		Pyrrhocoridae.			
118	256, 258	*Dysdercus superstitiosus* F.	AA	±	Rose and grey, congregated together.
222	463, 581	*Roscius illustris* Gerst.	AA	−	Large, black with orange spots, red head. Highly conspicuous.

Remarks on the Pyrrhocoridae.

Both species offered were treated as distasteful.

		Reduviidae.			
31	41	?	A	±	Slender, black speckled with yellow.
39	56	?	A	+	Grey with tips of tegmina reddish.
268	560	?	A	(±)	Powerful black apterous species.
		Family not known.			
28	38	?	AA	±	A solid rose-pink, apterous specimen found on dead tree. ? young of 162.
162	344	?	P	+	Rose-pink body concealed by grey tegmina.
205	435	?	A	+	Possibly same as 41 (Pentatomid).
		Homoptera.			
		Fulgoridae.			
200	420	*Pyrops maryinatus* Westw.	PP	−	Grey, with long snout, very procryptic.
239	493	*Hypselometopum morosum* Westw.	PP	−	The waxy abdomen particularly attracted M.'s attention.
		Cercopidae.			
207	438, 534, 569	*Triecophora conspicua* Dist.	AA	−−	Extremely conspicuous.

Remarks on the Homoptera.

Although two species were extremely procryptic, all were treated as distasteful.

General remarks on the Hemiptera.

It is seen that the verdict upon the group as a whole is decidedly unfavourable, although quite a number are very definitely procryptic. The powerful, and to man, unpleasant odour does not, however, seem to be a cause of distastefulness, seeing that the very malodorous large Coreid, No. 42, seemed to be a pleasant article of food, although M. seemed to fear its powerful rostrum.

SECTION III.

Further Experiments with a Cercopithecus on Relative Edibility of Insects.

At the beginning of February, 1917, the young male monkey which I had borrowed for the purpose of experiment was reclaimed by his master and, much to my regret, I lost him. There was, however, another monkey in the station, and I continued the taste-experiments with him. He also was a young male of the same age, and, so far as I could tell, of the same species of *Cercopithecus ;* he was of the common grey-green type with black hands and face and dull whitish band across the forehead. His temperament, however, was different from that of M_1,—he was quieter and not so boisterous, and at first not nearly so ready to eat insects. His owner, who had kept him from babyhood, had never given him insects to eat and, as he had always been kept tied up (when I experimented with him he was on the upper balcony of a house), he had probably not had much, if anything, in the way of insect food.

His manners were somewhat different from those of M_1. Sometimes when dealing with a very objectionable insect that M_1 would have rubbed violently on the ground, M_2 would leap up in the air and come down heavily with one hand on the insect, which would thus be disabled.

Owing to the fact that M_2 was not under my control I was not able to supervise his feeding entirely, as I had done with M_1, so that, except for the fact that he soon showed whether or not he was hungry for *insects*, I could not tell in what state he was at the commencement of an experiment.

The experiments were carried out, and records made, in precisely the same manner as described in the M_1 series of experiments. A total number of 131 species were used for M_2, of which 55 had been previously tested on M_1. These latter therefore were doubly tested, and a table at the end of the paper, comparing the treatment of the two monkeys, brings out some interesting points of difference.

Series a. *Obs.* 616—619. *Feb.* 6.

Obs. 616. *Sp.* 44.—Pentatomid, probably *Aspongopus viduatus:* a large dark brown bug. When it flies it exposes the red upper surface of the abdomen. It was offered in a box with a specimen of the Tenebrionid beetle *Macropoda transversalis*, and was taken out in preference to the beetle. M_2 examined it very attentively, bit off and ate the head and thorax, then pulled open the tegmina and wings so that the red abdomen was exposed, and then dropped the insect, which gave out the typical rank "bug" odour.

Obs. 617. *Sp.* 13.—The Tenebrionid beetle was picked up, bitten, and dropped.

Series β. *Obs.* 620–637. *Feb.* 7.—At 11 a.m., M_2 very hungry.

Obs. 620. *Sp.* 67.—Asilid, *Hoplistomerus serripes:* M_2 appeared to be deceived by the Hymenopteroid appearance of this fly: he looked at it very suspiciously, took it up gingerly, and put it down. As he was not stung he took it up again, re-examined it, bit off its head and finally ate the fly with appreciation.

(*Note.*—The behaviour of the monkey was most interesting and very strongly suggested that this fly is a true Batesian mimic, *i. e.* pseudaposematic and edible.)

Series γ. *Obs.* 638–651. *Feb.* 7.—At 5 p.m. M_2 was quite ready for more insects.

Obs. 638. *Sp.* 186.—Six staple grasshoppers (*Catantops decoratus*) eaten greedily.

Obs. 639. *Sp.* 262.—Zygaenid, *Neurosymploca xanthosoma:* this moth was offered in the lid of a chip box. M_2 smelt it once, then for a time paid no more attention to it. As I still held it out to him he put out a hand and touched it. The Zygaenid lifted its wings so as to expose the bright yellow abdomen, hitherto concealed. M_2 would then have nothing more to do with the moth.

(*Note.*—The deliberate exposure of an aposeme by the moth, when interfered with, and the recognition of it as such by the monkey, are of much interest. When this moth, of a universal dull black, save for a yellow spot on each side of the thorax, and the yellow abdomen, is quietly at rest on a grass stem the wings completely cover the abdomen. But the abdomen is quite conspicuous when the moth flies, with the typical straight, heavy flight of the family.)

Obs. 640. *Sp.* 195.—Megalopid, *Poecilomorpha apicata :* this Lycoid bettle was smelt, put up to the mouth, tasted, and thrown away. After a little time M_2 jumped down, picked up the beetle and pulled it to pieces, but tasted none.

Obs. 641. *Sp.* 244.—Cerambycid, *Anubis* (*Oligosmerus*) *limbalis :* M_2 looked doubtfully at this bright green Longicorn, but ate it without definite sign of distaste.

Obs. 642. *Sp.* 295.—Pentatomid Bug of same type as 44, with reddish upper surface of abdomen. This was handled very doubtfully, turned over and over; the tip of the abdomen was tasted, but obviously not much relished. At last M_2 appeared to make up his mind to face a nasty morsel and ate it up quickly, and then jumped down and ate some dates immediately.

Obs. 643. *Sp.* 242.—Buprestid, *Sphenoptera disjuncta :* this beetle was taken without hesitation and eaten with gusto.

Obs. 646. *Sp.* 296.—Cerambycid, *Phyllocnema* sp.: about the size of the "musk beetle" and smelling like it. Deep blue with brownish-yellow legs banded with dark blue, the hind tibiae each having a large flat expansion of blue colour, the antennae brown at base, blue at ends. This beetle is very aposematic on the wing, as I first saw it. It was offered to M_2, who looked at it but no more. After a few minutes it was offered again : M_2 gave it one bite and quickly dropped it.

Obs. 649. *Sp.* 297.—Hesperid, *Leucochitonea hindei :* a large white skipper with black apex to the fore-wing. Offered to M_2, but he made no attempt to take it.

(*Note.*—This butterfly has the same general appear-

ance as many of the white species of the Pierine genus *Belenois*. Like them it frequents puddles, and drinks with them. I have often seen *Belenois* settle close by it when it had alighted on the mud with wings expanded; it almost appeared as if the *Belenois* chose to settle with it because of the resemblance, for it is well known how species of the same coloration keep together when assembling at mud. The first of these skippers that I saw seemed to me strongly suggestive of a small *Belenois*.

It is to be noted that M_2, who made no attempt to take this butterfly, did not appear to find *Belenois* nearly as palatable as M_1 had done.)

Obs. 650. *Sp.* 174.—Pierine, *Catopsilia florella*: M_2 would only take this greenish-white butterfly when persuaded; he pulled it about much, ate the abdomen and, after more pulling about, ate the thorax.

Obs. 651. *Sp.* 298.—Pierine, *Teracolus eupompe* Klug: a white butterfly with crimson tips. M_2 pulled off the wings and ate the body with no sign of dislike.

Series δ. Obs. 652–683. *Feb.* 8.—At 2 p.m., M_2 being very ready for insects. He ate 9 grasshoppers and refused *Dictyophorus productus*.

Obs. 656. *Sp.* 300.—Lamiid, *Ceroplesis malepicta* Fairm.: a Longicorn beetle of medium size, dull black with dull red bands, found sitting freely exposed on low herbage. M_2 pawed it a little, took and bit it quickly, then put it down. This beetle is decidedly aposematic.

Obs. 657. *Sp.* 301.—Locustid (possibly same as 203): a short, fat, wingless, green grasshopper. M_2 took it, bit the abdomen, then put the insect down, and allowed it to crawl. As I made a movement to take it M_2 seized it and hastily bit it up, but it was quite obvious from his previous behaviour that he had not intended to eat it.

Obs. 663. *Sp.* 304.—Phytophaga: a dull black beetle, with dull orange thorax, found sitting conspicuously on a leaf, and giving out a yellow juice when handled. M_2 pulled off the elytra, but ate the beetle without any sign of dislike.

Obs. 664. *Sp.* 305.—Reduviid, *Phonolibes bimaculatus* Dist., or allied species: a dull black bug with

rose-coloured abdomen. It was offered on my hand; M_2 smelt it and left it alone.

Obs. 676. *Sp.* 286 B.—*Danaida chrysippus*, form *dorippus :* the all-orange-brown variety. The butterfly was offered between my fingers, held by the body. M_2 took it, let it go, caught it again, tasted it, pulled it about, nibbled the abdomen, looked at his fingers as if he had soiled them, put down the butterfly and allowed it to be blown a little distance away, caught it again, pulled it about, tasted it again, and finally rubbed his fingers on the ground and left it still fluttering.

(*Note.*—M_2's repeated efforts to eat this butterfly and the rubbing of his fingers on the ground after handling it speak eloquently for its distastefulness.)

Series ϵ. *Obs.* 684–703. *March* 2.—In the afternoon, M_2 not having had any insects for some days, as I had been away—

Obs. 684. *Sp.* 314.—Carabid, *Tefflus* sp. : a very large, all-black ground-beetle. M_2 watched it run about with great intentness ; as it came near he put out a hand and leapt back high in the air. This he did a second time, and then climbed up on to his perch and sat there, obviously unwilling to tackle this formidable insect.

Obs. 685. *Sp.* 315.—Carabid, *Polyhirma* sp. : of same general type as 25, but with anterior half of elytra rusty black : a single median longitudinal whitish mark anteriorly, and two oblique whitish marks posteriorly. M_2 at first treated this like the last, though it was considerably smaller, but, becoming bolder, in one of his leaps he put out a paw and came down heavily on top of the beetle, partly crushing it and causing the abdominal viscera to protrude. M_2 pawed the beetle about a little more and then rapidly bit off the head and thorax, but could not tackle the abdomen, which, after being licked and pawed, was left.

Obs. 686. *Sp.* 316.—Meloid, *Nemognatha caerulans*, Fairm. : a small beetle which exposes itself freely on composite flower-heads; the head and elytra green, thorax orange. M_2 pulled it about, put it up to his mouth, pulled it to pieces, and tasted it in great doubt, then rubbed the remains on the ground.

Obs. 687. *Sp.* 22.—Acridiid, *Dictyophorus productus:* this grasshopper was pulled about; a piece of the abdomen was bitten off and spat out; then it was pulled to pieces, the pieces being tasted and spat out. M_2 was obviously hungry for insects, but could not stomach this aposematic species.

Obs. 688. *Sp.* 186.—Two staple Acridians (*Catantops decoratus*) eaten with great relish after a little examination, and a third was eaten after being pulled about.

Obs. 689. *Sp.* 317.—Buprestid, *Steraspis* sp., not in Br. Mus.: same sp. as 183, but more green than bronze. It shows a conspicuous transverse pale abdominal band when flying. M_2 took it at once, cracked it, pulled off the elytra, nibbled the head, looked again at it, then licked the abdominal viscera which protruded, and finally ate the whole beetle.

Obs. 690. *Sp.* 86.—Lycid, *Chlamydolycus trabeatus:* M_2 touched this insect, scratched himself vigorously, pulled off one of the elytra, and finally, to my surprise, ate the beetle.

Obs. 691. *Sp.* 318.—Reduviid: a long-limbed, rather slender, black bug, speckled with yellow. M_2 held it in his hand for such a long while that it pricked him with its proboscis; he very suddenly gave a start and popped it into his mouth and ate it; subsequently rubbing his hand.

Obs. 692. *Sp.* 308.—Curculionid, *Lixus* sp.: a large weevil with yellow bloom. Eaten at once with relish.

Obs. 693. *Sp.* 319.—Curculionid, *Lixus gracilis* Boh.: of same type as 308, but smaller and more slender. Eaten at once with relish.

Obs. 694. *Sp.* 320.—Cassidid, *Aspidomorpha tecta* Boh.: a typical "tortoise-beetle" with the pattern marked in bright gold, the remainder of the elytra transparent. It was eaten at once without any sign of dislike.

Obs. 695. *Sp.* 235.—Carabid, *Eccoptoptera cupricollis:* M_2 at first treated this as very objectionable, leaping into the air and coming down on to the beetle with one paw. He then took it in one hand, rubbed it with the other, quickly bit off the head and thorax, and ate it with relish. It was a ♂—differing from the

♀ in having a median, single, whitish, linear mark anteriorly instead of the two spots of the ♀.

(*Note.*—This species appears to have lost the typical foul odour of a Carabid beetle—and its resemblance to a *Mutilla* would seem to be Pseudaposematic, or Batesian mimicry. I was unable to make another specimen emit any smell whatever, under pressure. The monkey at first regarded it as highly objectionable, but having tasted it, afterwards ate it with relish.)

Obs. 696. *Sp.* 308.—Curculionid, *Lixus* sp.: two eaten with relish.

Obs. 697. *Sp.* 322.—A bug (probably a Pentatomid): medium-sized, shiny grey-black dappled with orange. M_2 took it in a very lackadaisical manner and pulled off the tegmina, thus revealing the red upper surface of the abdomen. He then pulled the bug about and ate it without any definite sign of dislike.

Obs. 698. *Sp.* 323.—Lymantrid, *Leucoma* sp. near *atricosta* Hmpsn.: a pure white moth, the wings thinly scaled, with a black spot on the fore-wing. The wings of one side having been cut off for record, it was allowed to flutter on the ground. M. watched it for a long time, and at last put out a hand and touched it. The moth at once ceased fluttering and lay quite still with the tip of the abdomen strongly curved ventrally. M. took it by one wing, smelt it and dropped it.

Obs. 699. *Sp.* 324.—Acraeine, *Acraea terpsichore* L., f. *rougeti* Guér.: a very common, small, black and orange-brown butterfly. The wings of one side were cut off. M. pulled off the other wings, put the body into his mouth and ate it. He sat absolutely still while eating it, in a curious stiff posture and with a doubtful, serious face, almost as if he was wondering whether he was going to be sick! In fact I couldn't make out why he ate it, as he got no enjoyment from it!

Obs. 700. *Sp.* 325.—Phytophaga: grey-brown beetle, streaked with blackish-grey; rotund, procryptic. Found hiding on the under-surface of a leaf. M. handled it without much interest, tasted it, then ate with apparent pleasure.

(*Note.*—I came across very few procryptic

Phytophaga during these experiments, and it is interesting that this one seemed edible.)

Obs. 701. *Sp.* 326.—Tenebrionid, *Sepidium muscosum* Gerst.: of same type as 46, but of a more uniform earth-colour and much more bristly. M_2 took it, felt it, put it up to his mouth, held it in one hand and rubbed it with the other as if to try and get the bristles off, then bit off the head and dropped the remainder.

Obs. 702. *Sp.* 308.—Curculionid, *Lixus* sp.: this weevil was eaten with relish.

Obs. 703. *Sp.* 186.—Acridiid, *Catantops decoratus*: several of these favourite grasshoppers were offered in a box, but M_2 only ate one and that not eagerly. He was presumably satisfied by the numerous insects he had eaten.

Series ζ. *Obs.* 704–733. *March* 4, 2.30 *p.m.*—M_2 had been asleep, but was quite ready for insect food.

Obs. 704. *Sp.* 327.—Drilid: a beetle larva, about $2\frac{1}{2}$ inches long, red-brown and black, bristly. Found crawling on the ground. M_2 watched it from a distance with great interest, and kept coming to look more closely at it and then running away, but showed no desire to touch it.

Obs. 712. *Sp.* 329.—Cetoniid, *Protaetia carneola* Burm.: a small procryptic beetle, dark brown mottled with black and dark grey. Offered to M_2, who took it after looking at it, but suddenly put it down in a great panic and ran away. The beetle *may* have bitten him, but apparently it kept motionless. I offered it again and the monkey took it, smelt it, and threw it down.

Obs. 718. *Sp.* 170.—Pierine, *Mylothris agathina*: a ♀, offered in my fingers. M_2 was not at all eager to take it, and allowed it to fly away. I re-offered the butterfly; M_2 grabbed it, put it down and danced on it as if it were a formidable Carabid (see *Obs.* 685, 695), then pulled off the wings, but did not taste it. After a little he went back to it, pulled it about, pawed it, and pulled off the abdomen, which he put in his mouth, but did not appear to like. He did not eat the rest. He afterwards ate three *Lixus* weevils, and a ground-weevil.

Obs. 725. *Sp.* 332.—Cassidid: a pupa, about half

an inch long, black, spiny. Offered on the leaf to which it was affixed conspicuously. M_2 was much more interested in the leaf, but smelt, handled, nibbled the pupa and discarded it.

(*Note.*—This observation is particularly interesting because, unlike M_1, M_2 had previously eaten *all* the Cassidid beetles offered to him. This pupa belonged to a large species, probably 251.)

Obs. 728. *Sp.* 334.—Lymantrid, *Arctornis* (*Euproctis*) *producta* Wlk.: a pure white moth with the black tip of the abdomen surrounded by yellow hairs as in our "gold-tail." Offered at rest in a box. M_2 looked very closely at it and licked a wing, whereat the moth protruded the tip of the abdomen dorsalwards between the edges of the wings. M_2 again put his mouth close down, but I could not see whether he licked the moth again. He pawed it on the ground and left it.

(*Note.*—Compare the behaviour of the Zygaenid, *Obs.* 639.)

Series η. Obs. 734–765. *March* 7.

Series θ. Obs. 766–787. *March* 10, at 2.30 p.m.: M_2 quite ready for insects.

Obs. 766. *Sp.* 350.—Mantid: a young green specimen. It was offered to M_2, who to my intense surprise looked at it as if not knowing what it was. He then pulled it about, tasted it, and left it. Afterwards he came back to it and ate the pieces.

(*Note.*—It is likely that this was the first mantis that this young monkey had ever seen, for he had been a captive from extreme babyhood. It is worth comparing this observation with 26, when M_1 first met the big mantis of which he subsequently ate numbers.)

Obs. 774. *Sp.* 351.—Noctuid larva: a leaf-green, extremely procryptic caterpillar. M_2 took it and held it wriggling in his hand for a long while. I feel quite sure he had not seen one before, as I had never taken caterpillars to him. He then bit off half and ate it with great satisfaction, afterwards eating the rest and licking up from off the ground a large drop of the visceral contents which had exuded.

Obs. 782. *Sp.* 357.—Chrysomelid: a small, compact, inconspicuous brown and black beetle, but it

exposes itself like a conspicuous species. Being small M_2 put it into his mouth without adequate inspection; he afterwards pulled it out and threw it away.

(*Note.*—Although not conspicuous in colouring this little beetle appeared to be distasteful. But its habit of freely exposing itself is that of a distasteful species; its colouring is such that variation might easily make it conspicuous. One can quite well conceive that aposematic colours might be developed thus.)

Series ι. *Obs.* 788–809. *March* 15, at 3 p.m.

Obs. 789. *Sp.* 359.—Acridiid: rather a large grasshopper, very procryptic, dark mottled grey, showing when it flies conspicuous yellow, black-bordered wings. M_2 bit off its head, then pulled it about a good deal, pulling off the yellow wings after looking at it much, finally eating it.

(*Note.*—Compare notes on the coloured wings of Acridians given previously.)

Obs. 793. *Sp.* 361.—Buprestid, *Sternocera laevigata* Kolbe: only one specimen, the type, in the British Museum. A large beetle, head and thorax black, elytra shining light brown, quite conspicuous. M_2 was eager to take it, but found it extremely hard. After several attempts to break it up, he put it down almost in despair, but at length managed to extract the soft parts, which he ate with satisfaction.

Obs. 799. *Sp.* 366.—Longicornia: a medium-sized, dark-brown, beautifully procryptic Longicorn beetle. It was offered to M_2 on my finger; it lay as if dead and he took it as if not quite sure what it was, and put it down. Eventually he took it up, looked at it again, and ate it with gusto.

(*Note.*—Seeing that even when the beetle was seen out of its natural surroundings the monkey did not at first seem at all certain what it was, it is probable that when in its natural haunts the beetle would often escape being eaten.)

Series κ. *Obs.* 810–836. *March* 18, at 10.30 a.m., M_2 quite ready for insects.

Obs. 816. *Sp.* 174.—Pierine, *Catopsilia florella:* a ♀ was offered, but though M_2 took it willingly he allowed it to escape untasted.

Obs. 817. *Sp.* 313.—Pierine, *Herpaenia eriphia:* M_2 danced on this butterfly, as he did with *Mylothris*

agathina (Obs. 718), and pawed it, but would not taste it. It is a pale yellow species, barred with black, procryptic beneath.

Obs. 818. *Sp.* 172.—Pierine, *Belenois mesentina:* this butterfly was pawed about, and rubbed on the ground; M_2 eventually pulled off the wings and put the body into his mouth, but, to my surprise, took it out again.

(*Note.*—M_2 differs much from M_1 in his opinion of this butterfly. See Obs. 510.)

Obs. 819. *Sp.* 141.—Acraeine, *Acraea neobule* Dbl.: a semi-transparent red species. M_2 seized this butterfly and put it up to his mouth, took it out and looked at it, bit off the head, then put the insect down and left it alone.

(*Note.*—It did not appear as if the monkey recognised this *Acraea* at first sight as distasteful.)

Obs. 820. *Sp.* 171.—Nymphaline, *Precis antilope* (= *simia*): M_2 carefully pulled off the wings of this butterfly and ate the body with relish.

Obs. 821. *Sp.* 370.—Locustid: a short, fat-bodied, grass-green grasshopper not in the Br. Mus.; an adult winged specimen. Found among grass, where I should never have seen it unless it had betrayed itself by a movement. When I put it before M_2 he seemed at first very eager for it, but when it crawled within reach he took it and pulled off each hind leg in turn, tasting them. He then pulled out the viscera and put them in his mouth, but afterwards ejected them, and left the rest uneaten.

(*Note.*—This insect being so procryptic might have been expected to be edible, but this group of fat-bodied Locustids as a whole seems to be distasteful, in spite of the procrypsis.)

Obs. 822. *Sp.* 308. — Curculionid: two staple weevils (*Lixus*) eaten eagerly.

Obs. 823. *Sp.* 371.—Nymphaline, *Atella phalantha:* a very abundant butterfly, of a "Fritillary" appearance. M_2 appeared very eager for this, apparently not knowing it. He pulled off the wings, put the body straight into his mouth, and spat it out.

Obs. 824. *Sp.* 172.—Pierine, *Belenois mesentina:* M_2 pulled off the wings of this butterfly, put the body into his mouth, pulled it out, put it in again, and at last swallowed it after much mouthing.

(*Note.*—Again M_2 showed strong contrast with M_1 in his opinion of this butterfly.)

Obs. 825. *Sp.* 352.—Lycid, *Lycus ampliatus:* the wings and elytra of this beetle were pulled off, the body put up to mouth, then put down.

After these observations M_2 ate 18 insects of various kinds.

Series λ. *Obs.* 837–868. *March* 20. At 3 p.m. M_2 did not seem very eager at first, but later became so.

Obs. 841. *Sp.* 52.—Lamiid, *Dirphya similis:* a ♀. M_2 violently rubbed and pawed this Longicorn on the ground and pulled it about, holding it down by the antennae and pawing the body with his other hand. At length he studied it with great interest, gingerly tasted it several times, and finally ate it with gusto.

(*Note.*—M_2 behaved to this beetle as if it were pseudaposematic; M_1 (Obs. 98, 99) treated it as though synaposematic (see pp. 92, 93, 99).

Obs. 842. *Sp.* 350.—Though this mantis was only half grown, M_2 seemed quite afraid of its forelegs. He picked it up at once and ate the abdomen; the thorax with the struggling forelegs lay on the ground, and M_2 violently rubbed them on the ground before eating the whole with gusto.

Obs. 857. *Sp.* 381.—Longicornia: a Longicorn beetle, dull black with three narrow transverse bands and other markings of dull rose colour, somewhat aposematic. M_2 seemed to recognise the typical shape of the Longicorn and was very eager for it at first, but apparently had not seen its colours. For when I put it on the ground it fell on its back, and he at once took it and bit off its head and thorax. He then looked at it in surprise, took the rest of it up to his perch, where he pulled it to pieces, tasted it, but left most of it uneaten.

Obs. 862. *Sp.* 283.—Lampyrid: M_2 picked up this beetle larva, bit off the end of the abdomen, then put down the larva in surprise, looked at it (*which he had not done before*) and left it.

(*Note.*—The careful attention paid to this black and pink larva after it had been found to be inedible suggests very strongly that the monkey was "learning it." Cp. Obs. 857.)

Series μ. *Obs.* 869–901. *March* 25. At 2 p.m. M_2 very hungry for insects.

Obs. 874. *Sp.* 382.—Asilid: a fly of which the ♀ has a strong resemblance to a small brown bee; the ♂ is black. I offered M. a ♂, which he took from the forceps and ate without hesitation: I then offered the bee-like ♀, which M_2 took and hurriedly bit, as if he was afraid of it; he then looked at it in surprise and ate the rest of it in a more leisurely manner.

(*Note.*—It was very difficult to avoid the conclusion that the monkey thought the ♀ fly was something else than it was. He had eaten the ♂ without hesitation, and after he had found the ♀ innocuous, he ate it also. It appears to be a case of Batesian mimicry.)

Series ν. *Obs.* 902–914. *March* 28. At 10.30 a.m. M_2 squealing with eagerness.

Obs. 913. *Sp.* 391.—? Clerid: a beautiful mimic of a *Mutilla*, about ½-inch long, rather cylindrical in shape; dull red anteriorly, black with white marks posteriorly. The beetle has short antennae, which it vibrates rapidly, exactly as does a *Mutilla*.

I found it on the tip of a grass stem. When it was put on the ground in front of M_2, he treated it exactly as he and M_1 had treated Mutillids, and at once pawed it on the ground, throwing it about. I then tried to get it again for record, but the monkey seized it and very quickly put it into his mouth and crunched it up rapidly, as he would a *Mutilla*. But he afterwards spat it out again. The resemblance therefore seems to be synaposematic. After this experiment M_2 ate 8 weevils (*Isaniris* sp.).

SECTION IV

ORTHOPTERA.

Sp. No.	Obs. No.	Name.	Colour.	Edibility. M_2	Edibility. M_1	Remarks.
		Forficulidae.				
201	739	*Forficula senegalensis* Serv.	C	⊜	⊜	M_2 agreed with M_1 about this earwig.
		Mantidae.				
350	766, 842	?	PP	±		Young green specimens.

Remarks on MANTIDAE.

M_2 was not nearly so eager for young mantis as M_1 had been. Unfortunately Mantids were not so abundant at this time as when M_1 was used, but I believe the above indication was a true one of M_2's attitude towards them. It would have been very interesting to test him with Sp. 19.

Sp. No.	Obs. No.	Name.	Colour.	Edibility. M_2	Edibility. M_1	Remarks.
		Acridiidae.				
22	653, 687, 772	*Dictyophorus productus* Bol.	AA	−−	−−	M_2 agreed with M_1.
186	Numerous	*Catantops decoratus* Gerst.	P	++	++	Used as staple food.
359	789	?	PP	±		Dark grey; yellow wings bordered black.
369	810	?	PP	++		Green and brown; yellow wings bordered black.
		Locustidae (Tettigoniidae).				
176	644, 711, 853	*Gymnoproctus* sp., immature.	P	⊜	⊜	M_2 agreed with M_1.
267	672, 815	*Poecilogramma* sp.	A	±	−−	Both monkeys classed it as distasteful.
293	628, 714	Immature.	A	−		Short, fat, black and dull orange.
301	657	,,	PP	±		Grass-green.
302	658	,,	PP	−−−		Grass-green, legs darker.
303	659	?	PP	−−−		Grass-green, adult.
370	821	Species not in Br. Mus.	PP	−		Grass-green, adult, large.
384	881	*Poecilogramma striatipennis* Karsch.	A	±		Dull purple, yellow and black.

General remarks on the LOCUSTIDAE (TETTIGONIIDAE).

M_2 was more decisive than M_1 about the distastefulness of *all* Locustids offered him, although some were exceedingly procryptic. As with the experiments on M_1, all the species were of the type with short fat bodies. The remarks on the experiments with M_1 should be borne in mind.

HYMENOPTERA.

		Formicidae.				
53	732	*Megaponera foetens* (cocoons).		++	++	M_2 agreed with M_1.

COLEOPTERA.

		Scarabaeidea. Cetoniidae.				
153	667	*Leucocelis haemorrhoidalis* F.	AA	−	−−−	Classed as distasteful by M_1 and M_2.
329	712	*Protaetia carneola* Burm.	P	−−−		Dark brown, mottled with black and grey.
380	852	*Tetragonorrhina induta* Jans.	P	−−−		Dark grey, hairy.

Remarks on the Cetoniidae.

M_2 agreed with M_1 that these are distasteful, although two were procryptic.

Sp. No.	Obs. No.	Name.	Colour.	Edibility. M_2	Edibility. M_1	Remarks.
		Melolonthidae.				
368	804, 891	*Eriesthis* sp.	P	+		
		Trogidae.				
231	893	*Trox incultus* Boh.	P	±	−−	Classed as distasteful by M_1 and M_2.
		Caraboidea. Carabidae.				
235	695	*Eccoptoptera cupricollis* Chaud.	AA	⊕	Þ	Treated alike by M_1 and M_2.
294	630	?	A	+		Small, black.
314	684	*Tefflus* sp. (? same as 177)	A	⊜		Very large, black. Possibly same as 177 and treated like it.
315	685	*Polyhirma* sp.	A	⊜		Black with dull white marks.
347	759	?	C	−−		Small, black and yellow-brown.
365	797	Prob. *Parachlaenius* sp., possibly *emini* Kolbe.	A	⊜		Medium size, very active, blue-black, termite-haunting.
387	905	*Harpalus* sp.	A	⊜		Black, dark brown legs.

Remarks on the Carabidae.

M_2 agreed with M_1 as to the distastefulness of ground-beetles, classing all as minus with two exceptions. One of these was small, the other was a mimic of Mutillids, and both monkeys appear to have taken it at first for the model and rubbed it on the ground, subsequently finding it good to eat. As was pointed out before, this beetle seems to have lost the typical Carabid odour.

		Polymorpha. Coccinellidae.				
98	660, 806	*Epilachna chrysomelina* F.	A	−	−−	M_2 seemed to find these a shade less disagreeable than M_1.
254	629	*Epilachna paykulli*, Muls.	A	+	±	
		Malacodermidae. Lycidae.				
86	621, 690, 715, 746	*Chlamydolycus trabeatus* Guér.	AA	±	−−−	
352	776, 825	*Lycus ampliatus* F.	AA	−		
378	843	*Lopholycus amoenus* Bourg.	AA	−−−		
385	892	?	AA	−		
		Drilidae.				
327	704	Larva.	AA	−−−		Orange with black patches. Large and conspicuous.
		Lampyridae.				
283	862	Larva.	A	−−−		M_2 agreed with M_1.

Remarks on the Malacodermidae.

M_2 seemed to agree with M_1 as to the distastefulness of these beetles and their larvae.

Sp. No.	Obs. No.	Name.	Colour.	Edibility. M_2	Edibility. M_1	Remarks.
		Melyridae.				
63	791	Gen. nr. *Prionocerus*	AA	−−−−	−−−−	M_2 agreed with M_1.
		Cleridae.				
391	913	?	AA	⊖		A Mutilloid species (probably synaposematic).
		Buprestidae.				
242	643, 764	*Sphenoptera disjuncta* Fähr.	P	++	++	M_2 agreed with M_1.
317	689	*Steraspis* sp., not in Br. Mus.	C	+		Dull green; shows white band (? aposematic) across abdomen when flying.
361	793	*Sternocera laevigata* Kolbe.	AA	+		Very large and hard, black and light brown.
342	751	?	AA	+		Black, large white marks on elytra, thorax edged green.
376	830	?	P	++		Bronze, about ½ in. long.

Remarks on the Buprestidae.

Like M_1, M_2 seemed to find these beetles edible, in spite of aposematic colouring in some species. But, as in Obs. 793, their hardness will probably save them in cases when the monkey is not hungry enough to tackle the job of cracking them.

		Heteromera.				
		Tenebrionidae.				
13	617	*Macropoda transversalis* Kolbe.	A	−	±	
36	783	*Lamprobothris fossulata* Müll.	*a*	⊜	−−	M_2 agreed with M_1.
69	709	*Rhytinota gracilis* Gerst.	A	++	±	? more experiments required.
215	635, 710, 801, 902	*Calamerus revoili* Fairm.	AA	−	⊜	Treated as distasteful by both monkeys.
326	701	*Sepidium muscosum* Gerst.	PP	−		Cp. M_1 with 46, which this generally resembles.
372	826, 861	*Paramarygmus metallicus* Fairm.	C	−		Rotund, dull bronze, polished.
156	851	Larvae, possibly of 215.	A	−−−	−	M_2 classed this as more distasteful than did M_1.

Remarks on Tenebrionidae.

M_2 only ate one of these, but only a single experiment was performed with it. The other species, and larvae, were

classed as inedible, and the two monkeys agreed about the distasteful qualities of these beetles.

Sp. No.	Obs. No.	Name.	Colour.	Edibility. M_2	Edibility. M_1	Remarks.
		Meloidae.				
316	686, 710, 773, 911	*Nemognatha* sp. ? *coerulans* Fairm.	AA	−−		Small : head and elytra green, thorax orange.
328	705, 869	*Mylabris praestans* Gerst.	AA	⊜		Very large, black and lemon yellow.
330	720	*Mylabris bipartita* Gerst.	AA	−−		Large, orange and black.
362	794, 872, 895	*Zonitis* sp.	AA	−		Active, slender, bright red with black limbs, synaposematic with some Phytophaga.

Remarks on the Meloidae.

M_2 agreed with M_1 about the qualities of these typically aposematic beetles, classing all as distasteful, though he was a little more ready to examine them than M_1. No. 362 belongs to a synaposematic group.

		Phytophaga. Sagridae.				
344	755	?	AA	+		Like 197, but smaller. ? male.
		Megalopidae.				
195	640	*Poccilomorpha apicata* Fairm.	AA	−−	−−−	Treated as distasteful by both monkeys.
		Crioceridae.				
292	625, 631, 854	?	AA	−		Orange with black limbs, one of a synaposematic group.
		Clytridae.				
271	670, 864, 866	*Tituboca sansibarica* Lefevr.	A	−	−	M_2 agreed with M_1.
272	855	*Diapromorpha (Peploptera)* sp. nr. *curvilinea* Jac.	*a*	−	−−−	Treated as distasteful by both monkeys.
		Eumolpidae.				
188	624	*Euryope batesi* Jac.	AA	−−	⊖	Treated as distasteful by both monkeys.
193	754	*Corynodes usambicus* Klb.	A	−	±	Treated as distasteful by both monkeys.
216	627, 707	*Corynodes raffrayi* Lefevr.	AA	−	⊜	Treated as distasteful by both monkeys.
309	671, 784	*Pseudocolaspis* sp. nr. *scricata* Marsh.	P	+		Dull bronze dusted with grey powder.

Remarks on the Eumolpidae.

Like M_1, M_2 treated these beetles as distasteful, except one species which was procryptic.

Sp. No.	Obs. No.	Name.	Colour.	Edibility. M_2	Edibility. M_1	Remarks.
		Chrysomelidae.				
217	626, 727	*Chrysomela* sp.	*a*	−−	−−−	Treated as distasteful by both monkeys.
348	761	*Chrysomela opulenta* Reiche.	C	−		Rotund, dull bronze.
357	782	?	*a*	−		Brown and black.
		Halticidae.				
386	899	*Polyclada* (*Diamphidia*) sp. nr. *pectinicornis* Oliv.	P	−−−		Large, greenish-grey, brown spots.
		Galerucidae.				
54	716	*Diacantha conifera* Fairm.	AA	−−	−−−	Treated as distasteful by both monkeys.
351	779, 808, 910	*Acnidia* sp.	A	−−−		Bright green, gregarious, active.
		Cassididae.				
38	763, 890	*Aspidomorpha hybrida* Boh.	A	±	−−	Bronzy green.
280	661	?	A	±	−−−	Fiery orange-pink, black spots.
320	694, 786	*Aspidomorpha tecta* Boh.	A	±		Tortoise pattern bright gold or fiery orange.
338	743, 865, 896	*Aspidomorpha hybrida* Boh.	P	±		Variety of 38, grey-green and procryptic.
355	780, 785, 800, 805	*Aspidomorpha quadrimaculata* Oliv.	P	±		Translucent grey variety: cp. 251 (M_1).
332	725	Pupa, probably of 355.	AA	−−		Black and spiny.
340	745	?	PP	+		Rough, dead leaf brown.

Remarks on Cassididae.

M_2 showed himself much more agreeably disposed towards this family than did M_1, which is very interesting. Certain species of procryptic hue turned out to be the same as some which had been classed as aposematic when offered to M_1—the coloration being somewhat different.

		Phytophaga (family unknown).				
304	663	? possibly *Chrysomela*.	AA	±		Black with orange thorax, rotund.
325	700	? ,, ,,	P	+		Grey-brown, streaked blackish, rotund.
		Longicornia.				
		Cerambycidae.				
244	641, 666, 775, 876	*Anubis* (*Oligosmerus*) *limbalis* Har.	C	++	+	Treated as quite edible by both monkeys in spite of the odour.
296	646	*Phyllocnema* sp.	AA	−		Dark blue and yellow brown with the aromatic odour well marked.
		Lamiidae.				
300	656	*Ceroplesis malepicta* Fairm.	AA	−		Black with red bands.
52	841	*Dirphya similis* Gah.	AA	+	−	The monkeys were not in accord.
		? **Family.**				
307	668	?	PP	+		Bark-colour.
333	726	?	P	++		Dull reddish, powdered black.
337	742	?	PP	++		Small, slender, brown.
366	799	?	PP	+		Bark-brown.
381	857	?	A	−		Dull black with pink bands.

Remarks on the LONGICORNIA.

With one exception the aposematic species were treated as inedible, the procryptic were eaten. The exception is a mimic of Braconids, and the resemblance *may* be pseud-aposematic, but the same species did not seem edible to M_1.

The common species 244, bright shining green, is rather difficult to class as regards its coloration (see notes on M_1). Both monkeys found it edible in spite of its odour.

Sp. No.	Obs. No.	Name.	Colour.	Edibility. M_2	Edibility. M_1	Remarks.
		Curculionidae.				
97	623, etc.	*Isaniris* sp., probably new.	P	++	++	Used as staple food.
221	729	*Microcerus spiniger* Gerst.	C	+	±	
252	828	*Blosyrus haroldi* Hartm.	PP	++	++	M_2 agreed with M_1.
306	665	*Mitophorus* sp.	P	++		Dull black, dull yellow lateral line.
308	669, etc.	*Lixus* sp.	P	++		Large, grey with yellow bloom: used as staple food.
319	693, 731	*Lixus gracilis* Boh.	P	++		Like 308, smaller, more slender.
331	724	?	PP	++		Rough, stony grey.
353	778	?	PP	++		Large, dark brown, white network.
356	781	?	PP	++		Dark brown.
364	796	?	PP	++		Stony grey.
377	838	*Larinus* sp.	P	++		General resemblance to 308, but smaller.

Remarks on the CURCULIONIDAE.

All the weevils offered to M_2 were procryptic except one, and all were greedily eaten. The two monkeys were quite in accord as to the edibility of this family.

		Rhopalocera.				
		Danaidae.				
286B	676	*Danaida chrysippus* L., f. *dorippus* Klug.	AA	−	±	M_2 treated this as more distasteful than did M_1.
		Acraeidae.				
104	886	*Acraea caldarena* Hew., f. *neluska* Oberth.	AA	−−	−−	M_2 agreed with M_1.
141	682, 819	*Acraea neobule* Dbl.-Hew.	AA	−−	−	M_2 treated this as more distasteful than did M_1.
324	699, 878	*Acraea terpsichore* L., f. *rougeti* Guér.	AA	+		

Remarks on the above butterflies.

M_2 caused some surprise by finding No. 324 not unpleasant, but agreed with M_1 as to the distastefulness of the other aposematic species offered him.

LEPIDOPTERA.

Sp. No.	Obs. No.	Name.	Colour.	Edibility. M_2	Edibility. M_1	Remarks.
		Nymphalidae.				
80	832, 888	*Precis clelia* Cram.	P	++	?	
93	677, 717, 833	*Precis cebrene* Trim.	P	±	++	M_2 treated this as less edible than did M_1.
171	820, 867	*Precis antilope* Feisth. ♂ = *simia* Wallgm.	A	++	+	This species was treated as edible by both.
173	897	*Precis natalica* Feld.	P	±	++	M_2 treated this as less edible than did M_1.
120	636, 839	*Hypolimnas misippus* L., ♀	AA	−	±	Both treated this as distasteful.
371	823	*Atella phalantha* Dr.	A	−		Orange brown with black spots.
345	757	*Byblia goetzius* Herbst.	P	−−−		M_2 found this procryptic species not at all to his liking.

Remarks on above Nymphalidae.

M_2 showed some difference of opinion from M_1; it is of interest that both treated *misippus* ♀ (mimetic) as distasteful. This strengthens the view that it is a Müllerian mimic (synaposematic).

		Pieridae.				
103	748, 884	*Terias senegalensis* Boisd.	P	+	+	M_2 agreed with M_1.
212	846, 859, 883	*Teracolus eris* Klug.	P	++	++	,, ,, ,,
298	651	*Teracolus eupompe* Klug.	P	+		White with crimson tips.
312	680	*Teracolus evarne* Klug.	P	−		Yellow, orange-tipped: like *Eronia leda*.
313	681, 817, 840	*Herpaenia criphia* Godt.	P	±		Pale yellow, barred black.
170	718, 722, 734	*Mylothris agathina* Cram.	AA	(±)	±	Classed as distasteful by both monkeys.
142	749, 831	*Pinacopteryx simana* Hopff.	P	++	++	M_2 agreed with M_1.
172	760, 818, 824, 849, 889	*Belenois mesentina* Cram.	P	−−	++	M_2 differed widely from M_1.
174	650, 735, 816, 877, 894	*Catopsilia florella* Fabr.	P	−	±	Classed as distasteful by both monkeys.
264	648, 674, 723, 736	*Eronia cleodora* Hübn.	PP	−	±	,, ,, ,,

Remarks on Pieridae.

The majority of the species dealt with, classed by the colours of the under-surface, are procryptic. The only aposematic species (No. 170) was treated by M_2 as highly objectionable, and also by M_1 as distasteful. It is curious that the extremely procryptic *Eronia cleodora*, No. 264, was found distasteful by both monkeys: the very abundant near ally, No. 174, was also classed as distasteful: perhaps this section of the Pieridae as a whole may have inherited a distasteful quality not lost by some of the most procryptic

members. It is also noteworthy that *Teracolus evarne*, which resembles *Eronia leda*, seemed to be somewhat distasteful. M_2 differed very widely from M_1 as to the edibility of *Belenois mesentina*.

In a letter to Professor Poulton received in June 1917 from Kibwezi, Mr. W. Feather says—"I have also been feeding a couple of monkeys with butterflies. They will occasionally eat the abdomen of *Danaida chrysippus dorippus* Klug. Acraeas and *Tirumala petiverana* they do not attempt to eat; the smell is quite sufficient. *Teracolus*, *Terias*, *Belenois* and *Precis* they eat without the least hesitation."

Sp. No.	Obs. No.	Name.	Colour.	Edibility. M_2	Edibility. M_1	Remarks.
		Papilionidae.				
311	679	*Papilio demodocus* Esp.	A	−		Black and lemon yellow: under surface like upper.
		Hesperidae.				
297	649, 860	*Leucochitonea hindei* Druce.	C	±		Black and white: much like a Pierine.
383	880	*Rhopalocampta pisistratus* F.	P	+		Yellow-brown, large.
		Heterocera.				
		Zygaenidae.				
262	639, 719	*Neurosymploca xanthosoma* Jord.	AA	−−	−	M_2 agreed with M_1.
		Lymantridae.				
323	698	*Leucoma* sp. nr. *atricosta* Hmpsn.	AA	−−		Pure white.
334	728	*Arctornis* (*Euproctis*) *producta* Wlk.	AA	⊜		Pure white: tip of abdomen black with yellow bristles.

Remarks on these moths.

All three highly aposematic species were classed as very distasteful.

		Noctuidae.				
351	774	Larva.	PP	+		Smooth leaf-green caterpillar.
		DIPTERA.				
		Asilidae.				
67	620, 673	*Hoplistomerus scrripes* F.	A	+	−−−	
382	874	?	A	+		♀ resembles a honey-bee, ♂ black.

Remarks on the ASILIDAE.

No. 67 so closely resembles a Hymenopterous insect that M_1 would not even catch hold of it. M_2, however, ate it and found it not unpalatable. No. 382 is interesting on account of its mimetic female: M_2 found the black male edible.

There is therefore reason for supposing that the mimetic resemblance of these flies to Hymenoptera is not Müllerian (Synaposematic), but Batesian (Pseudaposematic).

HEMIPTERA.

Sp. No.	Obs. No.	Name.	Colour.	Edibility. M_2	Edibility. M_1	Remarks.
		Heteroptera. Pentatomidae.				
41	634	*Callidea bohemani* Stål.	AA	+	−−	Marked difference between M_2 and M_1.
339	744, 798, 847	? same as 41.	AA	±		Blue and gold.
44	616	*Aspongopus viduatus* F.	A	−−	−−	M_2 agreed with M_1.
295	642	? same as 44.	A	±		Shows red abdomen in flight: very odoriferous.
310	675, 850, 863	*Anoplogonius aulicus* Germ., var. *uniformis* Dist.	AA	−−		Shining dark blue and red.
349	762	*Paramecocoris lautus* Stål.	PP	+		Colour of dead grass.
363	795, 858, 873	*Sphaerocoris annulus* F., var. *ocellata* Klug.	P	−		Convex, rotund, odoriferous, black and yellow-green.
375	829, 844, 882	*Caura rufiventris* Germ.	C	⊖		Dark brown
389	907	*Nezara viridula* L.	PP	−		Grass-green, odoriferous.
322	697	?	A	±		Grey-black dappled with orange.
343	752	Larvae.	AA	+		Dark blue, spotted with orange.
367	803	?	P	−−−		Small, grey.

Remarks on the PENTATOMIDAE.

M_2 was less definite about this family than was M_1, and the results from him are irregular: procryptic species were discarded and aposematic specimens eaten. But on the whole the family was classed as more or less distasteful.

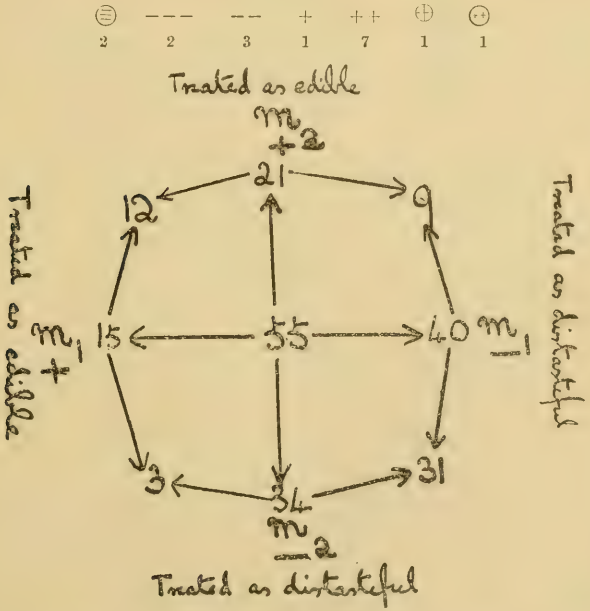
42	655, 737, 813, 887	**Coreidae.** *Anoplocnemis curvipes* F.	A	⊕⊕	⊕⊕	M_2 agreed with M_1. It is remarkable that both pawed this odoriferous bug on the ground, but ate it with relish.
		Lygaeidae.				
65	792	*Lygaeus* sp., not in Br. Mus.	AA	−−−	−−	Classed as distasteful by both monkeys.
87	619	*Oncopeltus famelicus* F.	AA	−−−	−	Classed as distasteful by both monkeys.
		Pyrrhocoridae.				
222	632	*Roscius illustris* Gerst.	AA	+	−	M_2 differed markedly from M_1.
		Reduviidae.				
305	664	*Phonolibes bimaculatus* Dist., or near it.	A	−−−		Dull black and rose.
341	750	*Vitumnus scenicus* Stål., typical form.	A	+		Orange, with dark background.
318	691	?	A	±		Black, speckled with yellow.
		? Family.				
346	758	?	A	+		Black and scarlet.

Hemiptera as a whole give more irregular results than other families, and further experiments are much needed. The odour that to us seems so very unpleasant does not appear to be considered a distasteful quality by the monkeys; moreover species were refused that had no perceptible odour. In one family may be found typically aposematic but comparatively odourless species, and extremely odoriferous but highly procryptic species.

Comparison between the two Monkeys.

M_2 seems to have been somewhat less severe in his judgments than M_1, as is shown by considering the fifty-five species offered to both. Of these, forty were put in the same class, *plus* or *minus*, by each monkey. But nine others classed as *plus* by M_2 were put in the *minus* class by M_1, and only three classed as *minus* by M_2 were put in the *plus* class by M_1 (see ring diagram below).

It is of some value to the results of these experiments that the monkeys should have agreed in $\frac{49}{55}$ cases. In quite a number of cases the agreement was exact; these are listed below.



The ring-diagram brings out well the accord between M_1 and M_2. In all cases where the majority was considered

to belong to one class by one monkey, there was also a majority on the same side by the other monkey.

There only remain a few remarks on some general points.

1. *A uniformly black, polished insect is regarded as distasteful.*

Sp. No.	Obs. No.	Name.	Edibility.
21	31, 301	*Hister validus*	⊜
69	133, 558	*Rhytinota gracilis.*	±
85	176	*Scarites superciliosus.*	− − −
100	212	Carabid larva.	⊜
140	314, 582	*Diplognatha silicia.*	− − −
166	352	Carabid.	⊜
225	467	*Rhytinota acuticollis.*	− −

2. *Aposematic species increase their conspicuousness by massing together.*

Sp. No.	Obs. No	Name.	Edibility.	Colour.
5	217	*Zonocerus elegans.*	− − −	AA
87	615	*Oncopeltus famelicus.*	−	AA
118	256, 258	*Dysdercus superstitiosus.*	±	AA
131	292	Phytophagous larvae.	− −	AA
156	336	Tenebrionid larvae.	−	A
187	388	Pentatomid larvae.	±	A
189	391, 399, 404	Lygaeid larvae.	+	AA
354	779, 808, 910	*Aenidia* sp.	− − −	A

3. *Among the Beetles are Synaposematic groups.*

(*a*) Orange or red with very dark limbs.

292 (*Crioceridae*), 188 (*Eumolpidae*), 216 (*Eumolpidae*), 3 (*Halticidae*), 258 (*Halticidae*), 362 (*Meloidae*).

(*b*) Orange and black (the " Lycoid " coloration).

10, 86, 198, 218, 236, 378 (*Lycidae*), 11 (*Cetoniidae*), 63 (*Melyridae*), 195 (*Megalopidae*), 54 (*Galerucidae*).

Instances of Mimicry.

It has been a matter of great regret to me that the foregoing work has such little bearing on Mimicry, but the material has been very poor; butterflies having been few and not mimetic. There are some cases, however, of mimetic insects, not counting the members of the two synaposematic groups just listed.

1. *The Longicorn beetle* DIRPHYA SIMILIS (No. 52) *mimicking one of the very large Braconids.*

This beetle is slender, and its likeness to the narrow body of the Braconid is accentuated by the disposition of the colours on the sides of the abdomen. Its orange and black colours very closely resemble those of the Braconid, and the antennae and legs in both are long and conspicuous, so that on the wing the beetle may readily be mistaken (Proc. Ent. Soc. Lond., 1918, pp. cxl, cxli). Obs. 98 shows that the monkey M_1, more or less well fed, would have nothing to do with this beetle; indeed he regarded it with extreme dislike. On the next morning, however, before the monkey had eaten anything, he took the beetle and, after examination and tasting, ate it slowly. M_2 treated it at first as very distasteful, but after careful study ate it with appreciation. It is difficult to say whether this is a case of pseudaposematic resemblance (Batesian, or true, mimicry) or of synaposematic resemblance (Müllerian mimicry). The only other aposematic Longicorns I have tested (see Obs. 646, 656, 857) were treated as distasteful. It may be argued that the only three Braconids tested in these experiments are listed as + ; but three single experiments all done in sequence will not convince me that the very typically aposematic large Braconids are not distasteful, in light of the evidence of the tables and chart in Section IV !

2. *The Carabid beetle* (235) ECCOPTOPTERA CUPRICOLLIS *mimicking the Mutillid scheme of colour.*

The beetle has dull red head and thorax and black elytra with four white spots. It appears to have lost the characteristic Carabid odour, but has acquired the gait of a *Mutilla*. M_1 appeared very afraid of this (Obs. 484), and pawed it violently, escaping out of reach after each attack, finally picking it up very quickly and hastily crunching it up as he did with those Mutillids that he ate. The fear of this beetle was far greater than it would have been had it been dressed in a normal Carabid livery, since for a medium-sized Carabid it was inoffensive-looking. One cannot avoid the feeling that the Mutilloid appearance accounted for his care not to be hurt by it. M_2 at first also treated this beetle as very objectionable (Obs. 695), but subsequently ate it with relish. Dr. G. A. K. Marshall in his paper on the Bionomics of S. African insects remarked upon the perfection of the mimicry of this beetle (Trans. Ent. Soc. Lond., 1902, pp. 511–2; see also Proc. Ent. Soc. Lond., 1918, p. xcviii).

3. *The butterfly* Papilio (Cosmodesmus) leonidas (No. 147) *mimicking the Danaine* Tirumala petiverana. Both model and mimic are pale blue with a coarse black pattern.

M_1 held the *Papilio* in his hand and looked at it for a long time, then having tasted it gingerly, ate it without a sign of dislike (Obs. 322). This suggests that M_1 had an instinctive feeling that it was an inedible butterfly, but having tasted and found it good, ate it. This appears to mean that the butterfly is pseudaposematic, but further evidence is required.

4. *The* Asilid *fly* (No. 67) *mimicking a Hymenopterous insect* (Scoliid).

This large fly has the abdomen covered with golden pubescence, and the wings clouded with brown, both characters giving it, with its wings folded in a position of rest, very much the appearance of a Scoliid. The first one I found was sitting fully exposed on a leaf in the late evening, and I was much struck with its resemblance, which was increased by the suppression of the large bristles so common in Asilids. It was offered to M_1 in a box (Obs. 129); he looked closely at it, but with suspicion. Just as it was about to fly away I caught it by the legs, so that the yellow pubescence of the abdomen was fully visible. M_1 would not catch hold of the fly, although he once put out his hand and gently touched a wing. The fact that on another occasion M_1 took and ate readily another equally large, and bristly member of this family of normal Asilid appearance (Obs. 142) shows that he was not objecting to the first because it was an Asilid. M_2 (Obs. 620, 673) handled the fly equally gingerly, but eventually found it was good to eat. This resemblance to a Hymenopteron would seem to be a case of true Batesian mimicry.

5. *Female Asilid fly* (No. 382) *mimicking a bee.*

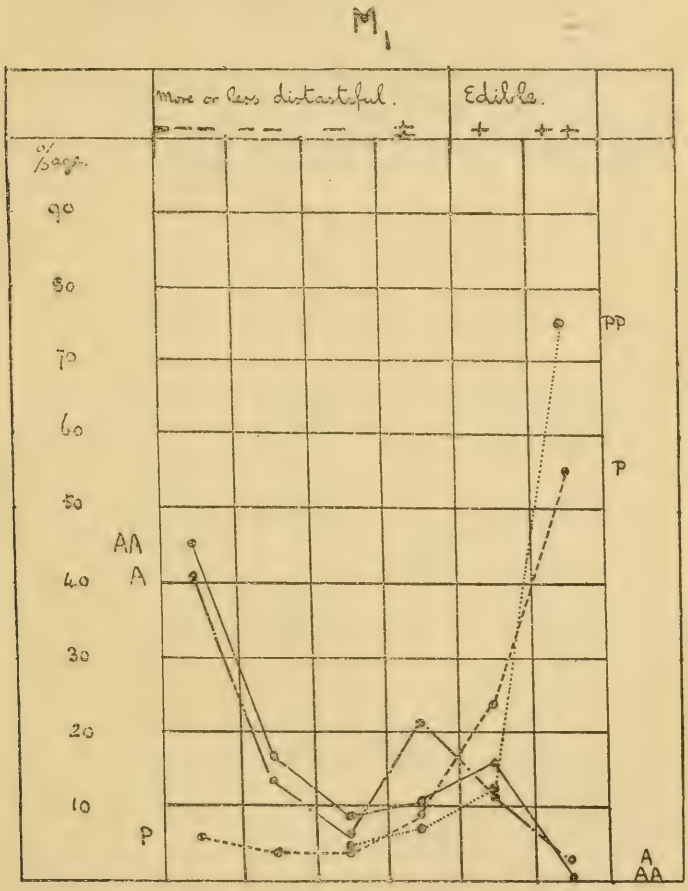
The fly is sexually dimorphic, the ♂ being uniformly black, the ♀ brown and bee-like. M_2 ate a male without hesitation, but his behaviour with the female (Obs. 874) left little doubt that he thought it was bee-like.

Since it was eventually eaten with satisfaction the female seems to be pseudaposematic; a case of true mimicry.

6. *Syrphid fly* (Eristalis tenax: No. 61) *mimicking the honey-bee.*

Just as the English honey-bee is closely resembled by *Eristalis tenax*, so is the African form of the same species,

and the resemblance is equally striking. In order to test the monkey with this fly, it was necessary to stupefy it so that it was not too ready to take wing, although it would buzz and crawl. Obs. 117, 216, 259 show that M_1 was so much



afraid of this fly that on each occasion when, after some doubt, he took it in his hand, he suddenly let it go or threw it down precisely as if it had stung him. It was extremely amusing to see, and suggested that his doubt was so great that when the fly buzzed in his hand he was obliged to let it go for fear of being stung: and Obs. 216 shows that he rubbed it on the ground precisely as he did the model

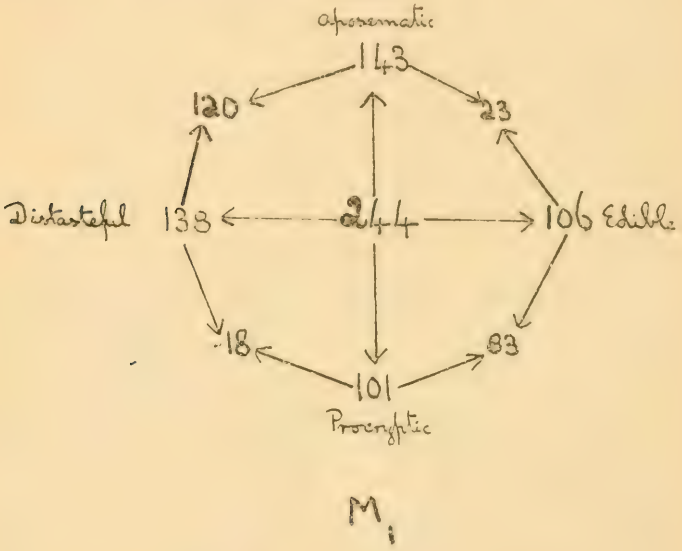
(Obs. 284) which was offered him on the day after the last of the flies.

General remarks on the results.

The foregoing mass of detail in the tables has been summarised for each monkey in the form of a percentage chart and a "ring diagram."

The chart shows for each of the four types of coloration the percentage of each of the six classes of "taste."

In the case of M_1 the practical experimental result could hardly be wished to accord better with the theoretical



result that should be obtained if the coloration of the insects has anything to do with their edibility.

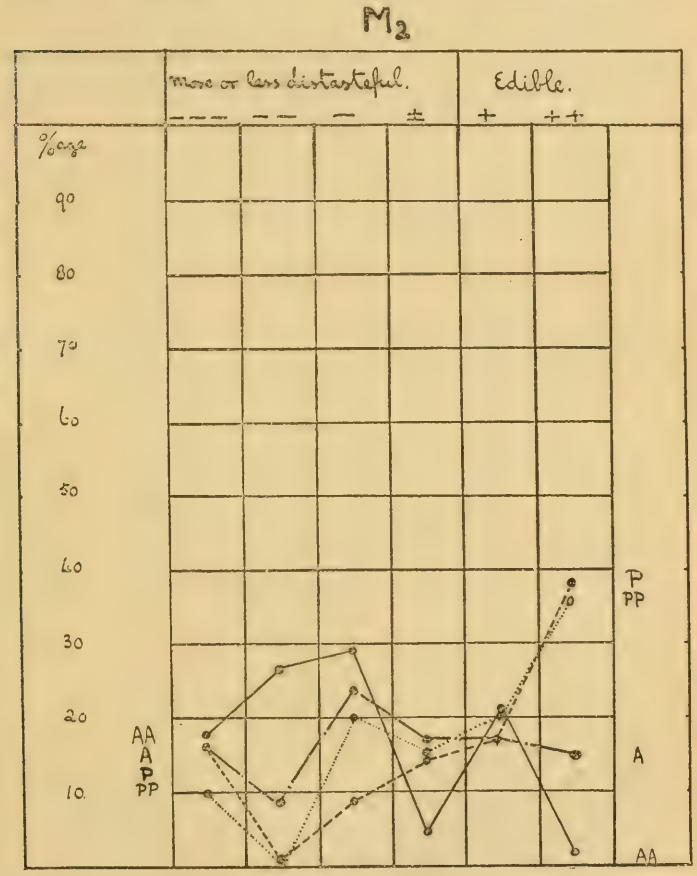
The two curves for aposematic species fall from the *minus* to the *plus* side of the chart, while the procryptic curves, one of which is not represented at all at the extreme end of the *minus* side, rise from the *minus* to the *plus* side.

The curves for M_2 are not so remarkable, but, broadly speaking, the result is the same, and the letters at the margin indicating the curves are inverted on the two sides as they should be.

The detailed comparison between the two monkeys seems

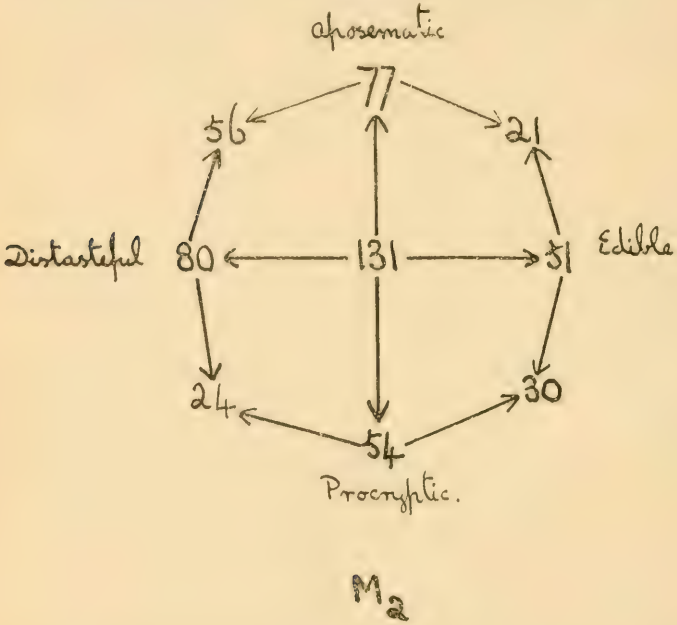
to indicate that M_2 was less severe in his classification as distasteful than was M_1.

The " ring-diagrams " give at a glance an analysis of the experiments with 244 species on M_1 and with 131 species on M_2. It is impossible for it to be a coincidence that of 143



aposematic species offered to M_1, 120 were classed by him as distasteful, while of 101 procryptic species 83 were found edible. Or, to take the result in another way, will coincidence explain the fact that of 51 species found by M_2 to be edible, 30 were procryptic, and of 80 found to be distasteful, 56 were aposematic?

It is claimed that these observations, numbering close on a thousand, upon insects taken at random as they were met with in the field, do yield practical, experimental support to the interpretation of the coloration of insects according to the Darwinian hypothesis of Natural Selection; that is, conspicuous species *are* distasteful and make the most of their conspicuousness to advertise the fact; while highly edible species endeavour to elude their enemies by hiding themselves. The fact must never be forgotten,



however, that edibility and distastefulness are not *absolute*, but entirely *relative*, qualities, and a hungry monkey will eat, though unwillingly, an insect that he would pass over disdainfully when not very hungry.

Great care was therefore taken throughout the experiments, after the first few, to record the state of hunger of the animal, and to gauge the distastefulness of an insect by the amount of food taken before and after a specimen was refused. A perusal of the records of the experiments will show how frequently the words staple food (grasshoppers or weevils) occur.

This paper would have been very incomplete without the names of species, and I am greatly indebted to the experts who have identified them so far as possible, namely, Dr. G. J. Gahan, Dr. G. A. K. Marshall, Mr. K. G. Blair, Mr. G. J. Arrow, Mr. W. L. Distant, Dr. H. Eltringham, Dr. F. A. Dixey, F.R.S., Lord Rothschild, F.R.S., and Dr. B. P. Uvarov. Many of the species are new, others are in the National Collection, but are unnamed.

To my kind friend Professor E. B. Poulton this paper owes much for the trouble he has taken to get species identified, and for continual practical interest shown in the work from the time the experiments were commenced in 1917 in what at that time was German East Africa.

II. *Notes on the Orthoptera in the British Museum.* 1. *The group of* Euprepocnemini. By B. P. Uvarov, F.E.S.

[Read February 2nd, 1921.]

In the course of rearranging the collection of Orthoptera in the British Museum, I have had the opportunity of making some hitherto unrecorded observations on previously known forms, as well as of finding some undescribed genera and species. Since the collection contains the types of numerous species described by Walker, I am also in a position to establish the synonymy of these. This is quite impossible for those who have not examined the types owing to the unsatisfactory nature of Walker's descriptions. Notes on the geographical distribution of species may also be of interest, the distribution of the Orthoptera being little known, and for this purpose I have included in this paper (which is the first of a proposed series based on the same collection) the data of all Museum specimens.

I am sincerely grateful to the authorities of the British Museum for permission to work on the rich and extremely interesting collection it contains.

The revision of the group Euprepocnemini recently published by Dr. I. Bolivar * saves me the trouble of giving a synopsis of the genera, since all new genera described below may be placed in Bolivar's synopsis without difficulty.

Genus Choroedocus I. Bol.

1878. ||*Demodocus* Stål, Bih. Sven. Akad., v (4), p. 75.
1893. ||*Demodocus* Brunner v. Wattenwyl, Ann. Mus. Genova, xxxiii, p. 150.
1914. *Choroedocus* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, pp. 5, 8.

As, thanks to the amiability of Prof. Y. Sjöstedt, I have been able to study Stål's type of *Demodocus capensis* Thunb., which is at the same time the type of the genus *Demodocus*, I think it useful to give a new description of

* Estudios entomologicos. Segunda parte, I, El grupo de los *Euprepocnemes*.—Trab. Mus. Nac. Cien. Natur. Madrid, ser. Zool., N 20, 1914.

the genus *Chorocdocus*, as I. Bolivar has proposed to name it, Stål's name being preoccupied.

Body rather compressed laterally. Head narrow, prominent. Frontal costa flat, slightly widened towards the clypeus and narrowed near fastigium of the vertex. The latter rather prominent. Vertex rather deeply triangularly impressed before the eyes, with slight short median longitudinal carina between eyes. Antennae filiform, in ♂ a little longer, in ♀ shorter, than head and pronotum. Ocelli placed close to the eyes, nearer to the base of antennae than to the side margin of the vertex. Pronotum compressed laterally; median carina low, but acute; interrupted by three transverse sulci; prozona a little longer than metazona; lateral carinae straight, slightly divergent backwards. Prosternal spine long, curved backwards to the mesosternum, cylindrical, rather acute. Mesosternal lobes a little longer than broad in ♂, nearly quadrate in ♀; interspace in ♂ twice, in ♀ a little less than twice, as long as broad. Metasternal lobes in ♂ contiguous, in ♀ narrowly separated. Abdomen in ♂ inflated posteriorly; anal segment very large, its hind margin with rounded emargination in the middle and two short obtuse prominences at the sides of this emargination; supra-anal plate large, impressed, with basal part rather narrowed, suddenly widened a little before the middle and widely lanceolate at the apex; cerci very large, slightly incurved, strongly compressed, with upper margin rather thick and rounded, while lower margin (as well as the hind) is very thin; inner surface of the cerci bearing an oval impression occupying the apical half and bearing scarce short hairs; subgenital plate a little longer than supra-anal, conical, slightly recurved, hairy. Hind femora attenuate in their distal third; hind tibiae with 12 spines outwardly (without an apical spine) and 10 spines inwardly; hind tarsi with short second joint.

I. Bolivar regarded as belonging to this genus four species: *Gryllus capensis* Thunb., *Acridium robustum* Serv. (which he rightly treated as a synonym of *Heteracris ducalis* Walk.), *Acridium sparsum* Serv., and *Demodocus amphiprosopus* Karsch. The latter species, of which I have studied both sexes, does not belong to this genus, and a new genus, based upon it, is described below. Both Serville's species are only known as yet from the female sex, and it is difficult to say if they actually belong here; I retain them in this genus only provisionally. On the other hand, two of Walker's species of *Heteracris* are true

Choroedocus, one of them being identical with *G. capensis* Thunb. Thus, the number of species of *Choroedocus* known to date is four, three of them being represented in the Museum collection. The genus is truly Oriental in its distribution, since Thunberg's *capensis*, in spite of its name, has proved to be an Indian insect.

1. **Choroedocus capensis** (Thunb.).

1815. *Gryllus capensis* Thunberg, Mém. Acad. Petersb., v, p. 270.
1827. *Gryllus capensis* Thunberg, l.c., ix, pp. 399, 423, no. 87, pl. 14, fig. 6.
1870. *Heteracris insignis* Walker, Cat. Derm. Salt. B. M., iv, pp. 663, 664, no. 20.
1873. *Pezotettix capensis* Stål, Recens. Orth., i, p. 76, no. 6.
1878. *C*[*alliptenus*] *capensis* Stål, Bih. Sven. Akad., v (1), p. 75, no. 2.
1910. *H*[*eteracris*] *insignis* Kirby, Syn. Cat. Orth., iii, p. 555, no. 13.
1910. *H*[*eteracris*] *capensis* Kirby, l.c., iii, p. 554, no. 1.
1914. *Heteracris capensis* Kirby, Fauna Brit. India, Acrid., p. 263, no. 324.

I have established the identity of *G. capensis* Thunb., and *H. insignis* Walk., by comparison of Walker's types with one of Stål's specimens, which has been also compared by Prof. Y. Sjöstedt with Thunberg's actual types. As one of Walker's types is from India, and there is a series in the Museum collection from the island of Hainan, with one specimen from China, it is evident that the species is an Oriental one. Stål's specimen of the male is also from India. It is, therefore, very strange that Thunberg should have described the species as a South African one, "*in campis Africae frequentissimus*"; the only explanation (suggested by Prof. Sjöstedt) is that Thunberg went to India after his stay in Cape Town, and the data on the specimens became mixed; the above-mentioned note of this author concerning the frequent occurrence of *Gryllus capensis* in Africa might be possibly referred to any species of *Heteracris*, the females of which somewhat resemble *Choroedocus*.

This particular species is separable from the very closely related *C. illustris* by more numerous and larger black spots on the elytra; the males also possess quite a good character in the shape of the subgenital plate which is

strongly conical in *C. illustris* and with apex truncate in *C. insignis*. One of the Hainan males has black spots on the elytra obliterate, but the form of its subgenital plate leaves no doubt that it belongs to *C. insignis*; Prof. Sjöstedt informs me that one of Thunberg's types, which are all females, also has unspotted elytra.

British Museum specimens: Buidwan, 1 ♀ (*Walker's type*); 1 ♀ without locality (*Walker's type*); Notai, Hainan, 5. vii. 1903, 7 ♂♂, 3 ♀♀, 1 larva; Amoy, China, 1 ♂.

2. **Choroedocus illustris** (Walk.).

1870. *Heteracris illustris* Walker, Cat. Derm. Salt. B. M., iv, pp. 662, 663.
1910. *H*[*eteracris*] *illustris* Kirby, Syn. Cat. Orth., iii, p. 555, no. 14.
1914. *Heteracris illustris* Kirby, Fauna Brit. India, Acrid., p. 263, no. 323.

British Museum specimens: S. Hindostan, 1 ♀ (*Walker's type*); India, 2 ♂♂, 1 ♀ (*H. M. Lefroy*).

The specimens sent by Prof. Lefroy agree perfectly with Walker's type in all details, and there is no doubt as to their identity.

3. **Choroedocus (?) robustus** Serv.

1839. *Acridium robustum* Serville, Hist. Natur. Ins., Orth., p. 647, no. 7.
1870. *Heteracris ducalis* Walker, Cat. Derm. Salt. B. M., iv, pp. 663, 665.
1910. *H*[*eteracris*] *robusta* Kirby, Syn. Cat. Orth., iii, p. 555, no. 15.
1914. *Heteracris robusta* Kirby, Fauna Brit. India, Acrid., p. 262, no. 322.

British Museum specimens: Silhet, 2 ♀♀; 1 ♀ without data (*Walker's types*).

I am not quite sure that this species actually belongs to the genus *Choroedocus*, since males are unknown. However, the females agree perfectly well with the two foregoing species as far as generic characters are concerned.

4. **Choroedocus (?) sparsus** Serv.

1839. *Acridium sparsum* Serville, Hist. Nat. Ins., Orth., p. 646, no. 6.

1870. *Heteracris* (?) *sparsa* Walker, Cat. Derm. Salt. B. M., iv, p. 670, no. 34.
1910. *H*[*eteracris*] (?) *sparsa* Kirby, Syn. Cat. Orth., iii, p. 554, no. 18.

Not represented in the British Museum.

It is quite probable that this species (described from Australia) does not belong to *Choroedocus* at all, but I still think it useful to include it here provisionally.

The three species of *Choroedocus*, known to me from specimens, may be easily distinguished by the aid of the following key :—

1. (4) General coloration yellowish-grey. Elytra with brown spots or points. Wings slightly infumated towards the fore margin and apex. Hind tibiae dull sanguineous or yellowish.
2. (3) Elytra with numerous rather large brown spots. Male subgenital plate truncate at the apex. . . *capensis* Thunb.
3. (2) Elytra with few small black spots and points. Male subgenital plate conical. . . . . *illustris* Walk.
4. (1) General coloration greenish-brown. Elytra without any brown markings. Wings strongly infumated except inner margin. Hind tibiae coral-red. . . . *robustus* Serv.

Genus Euprepocnemis Fieber.

I. Bolivar only included five species in this well-characterised genus, but my study of the British Museum collection has doubled this number, while I am able to describe a series of new species and forms, as well as to establish the correct synonymy of some others, hitherto little known. I give, therefore, a full list of the species of this genus, though some of them are not represented in the Museum collection.

1. **Euprepocnemis plorans** (Charp.).

The synonymy of this species given by Kirby (Syn. Cat. Orth., iii, p. 560, no. 1) is quite correct, except in the case of *E. plorans* var. *intermedia* Bol. (= *E. alacris* Serv., see below). I would add, however, the following synonyms :—

1846. *Calliptamus reticulatus* Fischer Waldheim, Orth. Imp. Ross., p. 239, tab. xix, fig. 1 (see Uvarov, Horae Soc. Ent. Ross., xl (3), p. 35).

1870. *Cyrtacanthacris ornatipes* Walker, Cat. Derm. Salt. B. M., iii, p. 575, no. 50.
1870. *Heteracris consobrina* Walker, l.c., iv, 673, 674, no. 40.
1891. *Cyrtacanthacris ornatipes* Hart, Fauna and Flora Sinai, p. 183, fig. 5.
1905. *Calliptamus reticulatus* Jacobson and Bianchi, Priamokr. i Lozhnos. Ross. Imp., p. 320.

The type specimen of *consobrina* has only one hind leg, which is pinned to it and does not belong to it; this leg seems to belong to one of the species of the genus *Zoniopoda*.

British Museum specimens: Syria, 1 ♀; Galilea, 2 ♀♀; Algeria, June 1856, 1 ♀ (*H. Clark*); Algeria, Bône, 3. xi. 1896, 1 ♀ (*A. E. Eaton*); Syria, 1 ♀; Dead Sea, Chor-es-Safiah, 1 ♀ (this is, evidently, the specimen figured in Hart, Fauna and Flora Sinai, p. 183, fig. 5); Inca, Majorca, March, 1 ♀ (*O. Thomas and R. I. Pocock*); two ♀♀ without locality (*Walker's types of consobrina and ornatipes*).

1*a*. **Euprepocnemis plorans pallida** subsp. nov.

Resembling in size and habitus the typical (Mediterranean) form, but the general coloration is pale with light-brownish markings; pronotum practically unicolored, the typical middle spot being but a little darker than the lateral keels; elytra without sulphurous axillar stripe, with distal half of radial veins brown; the venation of elytra does not differ from that in the typical form; brownish spots on elytra less numerous than in the typical form and light; hind legs pale without any markings or differently coloured parts except black spots on knee lobes. Length of body ♂ (type) 29 mm.; of pronotum 6 mm.; of elytra 28 mm.; of hind femora 17 mm.

The dimensions of the female cotype are: Length of body (♀) 35 mm.; of pronotum 7 mm.; of elytra 35 mm.; of hind femora 23 mm.

This form, as it is evident from the above description, differs from the typical *E. plorans* only in coloration, this difference being, however, so striking that I believe that I am correct in regarding it as a southern geographical form, that replaces the typical *E. plorans* (known with certainty from Mediterranean countries only) in Eastern Africa. This form is rather like *E. ibandana longipennis* Uvar., described below, but is easily distinguished by the venulation of the elytra, which is quite like that in typical

plorans, while in *ibandana* and its subspecies transverse veins, especially in axillar and discoidal fields, are sparse.

British Museum specimens: White Nile, Lake No, Feb. 1901, 1 ♂ (*L. Loat*) (*type*); Mombasa, 1 ♀ (*cotype*).

1*b*. **Euprepocnemis plorans meridionalis** subsp. nov.

Differs from the typical (Mediterranean) form in the following characters: frontal ridge more convex, scarcely punctured; elytra in both sexes not reaching the hind knees; hind femora distinctly incrassate basally, with distinct transverse bands on the upperside; general coloration pale fawn, with grey and black markings.

This subspecies is described from 3 ♂♂ and 2 ♀♀ from Bloemfontein, Orange Free State, 10 iii.—14 iv. 1918 (Division of Entomology, Pretoria); it is a quite well-defined geographical race.

2. **Euprepocnemis calceata** (Serv.).

1839. *Acridium calceatum* Serville, Hist. Nat. Ins., Orth., p. 683, no. 47.
1870. *Heteracris annulifera* Walker, Cat. Derm. Salt. B. M., iv, pp. 656, 659, no. 9.
1910. *H[eteracris] calceata* Kirby, Syn. Cat. Orth., iii, p. 555, no. 7.

I cannot agree with Bolivar (Trab. Mus. Madrid, l.c., p. 10), who regards *Acridium calceatum* Serv., as being synonymous with *Euprepocnemis ibandana* Giglio-Tos, since the coloration of the hind tibiae and femora in these two species is very distinct, and this in *E. calceata* perfectly agrees with the coloration in *annulifera*. Further, *ibandana* is an East (tropical) African species, while *calceata* is originally described from South Africa, whence come all the British Museum specimens, including Walker's type of *annulifera*.

Since Serville's and Walker's descriptions are not satisfactory, I give a new description of this species based on Walker's type (female):—

Size a little smaller than that of *E. plorans* Charp. Frontal ridge convex, sparsely punctate, slightly narrowed towards the fastigium. Impression on the vertex rather deep, rotundato-angulate anteriorly, marginal ridges strongly convergent between eyes. Pronotum as in *plorans*. Prosternal tubercle cylindrical, obtuse, bent backwards. Interspace between mesosternal lobes

longer than broad. Metasternal lobes short, non-contiguous, narrowly separated. Elytra with small brownish spots; scapular area without sulphurous stripe, sparsely venulated, transparent at its whole length, except the hind part of the basal third. Hind femora at the outer surface yellowish-grey, with a very narrow grey stripe along the upper outer keel; their inner surface of the same colour as the outer, but lighter; the inner lower sulcus greenish-yellow; knee lobes with grey spots inwardly and outwardly. Hind tibiae with upper surface greyish-greenish, with two pale rings at the base, divided by a dark grey ring (another dark grey ring is just below the second pale ring), and with a violet-rose spot at the lower end; their lower surface is yellowish-grey with two grey rings and a pale one included between them; the number of spines is 10 at the inner side and 12 at the outer; all spines are pale, with black ends. Hind tarsi violaceous-rose. Length of the body 28 mm.; of pronotum 6 mm.; of elytra 22 mm.; of hind femora 19·5 mm.; of hind tibiae 16 mm.

Males are quite like the described female; their metasternal lobes are contiguous; in the shape of the outer genitalia they are quite like *E. plorans*. The dimensions of a male (from Stellenbosch) are: Length of body 22 mm.; of pronotum 4·5 mm.; of elytra 16·5 mm.; of hind femora 14 mm.; of hind tibiae 12 mm.

The chief characters of this species are the form of the impression on the vertex and, especially, the peculiar coloration of the hind tibiae, as well as the rather large (for an *Euprepocnemis*) number of spines on the same. The lack of a dark median stripe on the outer median field of the hind femora is also a very good character to distinguish this species from *E. ibandana* G.-T., while from *E. plorans* it may be quite easily separated by the lack of the sulphurous stripe in the axillar field of the elytra and by the sparse venulation of this field. The coloration of the hind tibiae exactly coincides with the description of Serville's species, which is from the same locality, and this enabled me to confirm the identity of Serville's and Walker's species; Serville's observation concerning the shortness of the elytra in his species might be due to bad preparation of his specimen.

British Museum specimens: Cape of Good Hope 1 ♀ (*Walker's type of annulifera*); Stellenbosch, 2 ♂♂, 1 ♀; Capetown, iii, 1893, 2 ♀♀; Namaqualand (*C. D. Rudd*), 2 ♂♂, 3 ♀♀.

3. **Euprepocnemis ibandana** Gig.-Tos.

1907. *E*[*uprepocnemis*] *ibandana* Giglio-Tos, Boll. Mus. Zool. An. comp. Torino, xxii, 547, p. 30.
1907. *E*[*uprepocnemis*] *ibandana* Giglio-Tos, l.c. xxii, 554, p. 30.
1909. *Euprepocnemis plorans* Sjöstedt (*nec* Charp.), Wiss. Erg. Kilimand. Exped., 17, Orth., 7, Acrid., p. 189.
1910. *E*[*uprepocnemis*] *ibandana* Kirby, Syn. Cat. Orth., iii, p. 560, no. 5.

This species has been identified by most writers on the fauna of East Africa as *E. plorans* Charp.; thus I have examined the specimens from Kilimanjaro, quoted by Prof. Sjöstedt, and they proved to belong to *E. ibandana*. It is easily distinguished from *E. plorans* by shorter elytra with but sparse transverse venulation; especially characteristic is the sparse venulation and transparency of axillar field. The coloration of the hind legs is quite like *E. plorans*, and it is obvious that *E. ibandana* has nothing to do with *E. calceata* Serv., which has quite distinctly coloured hind tibiae, as is described above.

British Museum specimens: Uganda: Entebbe, Kampala, Kivuvu, Mabira forest, Bweya, Manokota, Bwera. 11 ♂♂, 73 ♀♀, 1 larva (*C. C. Gowdey*); British Centr. Africa, 1 ♀ (*A. R. Andrew*); British E. Africa, 1 ♀ (*Gregory coll.*).

3*a*. **Euprepocnemis ibandana** var. **nigromaculata**, nov.

General coloration darker than in the typical form, but the chief difference is in the coloration of the hind femora, which bear three confluent large black spots on the upper part of the outer median area; the lower part of the same area is of the usual colour. Dimensions and all morphological characters as in the typical form.

It is very curious that among nearly a hundred specimens of this species this peculiar coloration of the hind femora is to be seen in two only. I think that this form is a mere individual variety, which, however, is rather striking and ought to be named.

British Museum specimens: Entebbe, Uganda, 1915, 1 ♀ (*type*); Entebbe, Uganda, Nov. 1912, 1 ♀ (*co-type*).

3*b*. **Euprepocnemis ibandana longipennis**, subsp. nov.

Larger than the typical form, with elytra reaching hind knees or

even longer. Length of body (♂ type) 26 mm.; of pronotum 5 mm.; of elytra 21·5 mm.; of hind femora 16 mm.; of hind tibiae 13 mm.

The dimensions of the female cotype are: Length of body 38 mm.; of pronotum 7 mm.; of elytra 30 mm.; of hind femora 23 mm.; of hind tibiae 20 mm.

Specimens of *ibandana* from West Africa are distinguished from East African ones by their dimensions, and, especially, by their longer elytra. I believe that they belong to a distinct geographical race which replaces true *ibandana* in West Africa.*

British Museum specimens: Sierra Leone, 15 ix. 1912, 1 ♂ (*J. J. Simpson*) (*type*); Mayeppa, Sierra Leone, 14 ix. 1912, 1 ♂ (*J. J. Simpson*); Free Town, Sierra Leone, 13 ix. 1899, (*E. E. Austen*), 1 ♂; Oban District, S. Nigeria (*P. A. Talbot*), 3 ♀♀; Idanri, Lagos, 20 iii. 1910 (*A. B. S. Powell*), 1 ♂; Fernando Po, Fishtown (*P. A. Talbot*), 2 ♀♀ (*the eight latter specimens being cotypes*).

4. **Euprepocnemis senegalensis** I. Bol.

1914. *Euprepocnemis plorans* Charp. var. *senegalensis* I. Bolivar, Trab. Mus. Madrid, ser. Zool, N 20, p. 10.

I have not seen this insect, but from Bolivar's description it differs from *E. plorans* too much to be regarded as a mere variety of it. Bolivar's description is too short, and he does not compare *E. senegalensis* with the central African *E. ibandana* (which he wrongly considered to be identical with *calceata* Serv.), and therefore I think it useful to treat *E. senegalensis* as a distinct species till larger series of it may be obtained and its relationship established.

5. **Euprepocnemis cinerea** (Blanch.).

1853. *Acridium cinereum* Blanchard, Voyage au Pôle Sud, iv, p. 372, Ins. Orth. pl. 3, fig. 8.

This species is unknown to me from specimens, but it appears to be very near to *E. ibandana longipennis*, if not identical with it. The only point against it, is that *E. cinerea* is described from Teneriffe, while *longipennis* is

* Prof. Y. Sjöstedt has kindly submitted to me some specimens from Kamerun recorded by him as *E. plorans* (Ent. Tidskr, Arg. 31, H. 1, 1910, p. 8 of separate copy), but which actually belong to *E. ibandana longipennis*.

known from tropical West Africa only. In the event of their proving identical, the name *cinerea* will replace *longipennis*.

6. **Euprepocnemis alacris** (Serv.).

1839. *Acridium alacre* Serville, Hist. Natur. Ins. Orth., p. 682, no. 45.
1859. *Acrydium deponens* Walker, Ann. Mag. Nat. Hist. (3), iv, p. 222.
1870. *Heteracris rudis* Walker, Cat. Derm. Salt. B.M., iv, pp. 622, 664, no. 19.
1871. *Acridium scitulum* Walker, l.c., v, Suppl., p. 62.
1902. [*Euprepocnemis plorans* var.] *intermedia* I. Bolivar, Ann. Soc. Ent. France, lxx, p. 630 .
1910. *E*[*uprepocnemis*] *scitulus* Kirby, Syn. Cat. Orth., iii, p. 560, no. 2.
1910. *E*[*uprepocnemis*] *alacris* Kirby, l.c., p. 561, no. 15.
1914. *Euprepocnemis alacris* Kirby, Fauna Brit. India, Acrid., p. 267, no. 328.
1914. [*Thisoicetrus*] *alacris* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, p. 23.
1918. *Euprepocnemis alacris* I. Bolivar, Rev. R. Acad. Madrid, xvi, p. 411.

The synonymy of this species has been partly established by Kirby and given nearly in full by I. Bolivar in his recent paper on the Indian fauna (l.c. 1918). I can only confirm this synonymy after study of Walker's types, and add one new synonym—*Acridium scitulum* Walker.

This species is easily distinguished from *E. plorans* by the lack of a median carinula on the vertex. This carinula is present in all the known African species that form a natural group with *E. plorans*. It is interesting, therefore, to record that in the British Museum there are two female specimens of *Euprepocnemis* (one from the Blue Nile, the other from Abyssinia) which also have no carinula on the vertex; since, however, the material is so scanty, I do not venture either to describe these specimens as a new species or to identify them with *E. alacris*, though they very much resemble this species.

British Museum specimens: Pachim district, Siam, 1 ♂, 3 ♀♀; Benares, 6 x. 1894, 1 ♀; N.W. India, 2 ♀♀; N. India, 1 ♀; Bombay, 1 ♀; India, 1 ♀; Pusa, Bengal, 18 ix. 1908, on grass, 1 ♂; Ceylon, 1 ♀ (*Walker's type of*

Heteracris rudis); Ceylon, 2 ♀♀ (*Walker's types of Acridium deponens*); Pundaluoya, Ceylon, 1 ♂, 1 ♀ (recorded by Kirby as *Thisoicetrus littoralis* Rb.); Hakgalla, Ceylon, 1 ♀ (recorded by Kirby as *Euprepocnemis alacris* Serv.); 1 ♀ without locality (*Walker's type of Acridium scitulum*).

7. **Euprepocnemis malagassus** I. Bol.

1914. *Euprepocnemis malagassus* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, p. 11.

I have not seen this species, but it appears to me to belong to another genus.

8. **Euprepocnemis hokutensis** Shiraki.

1910. *Euprepocnemis hokutensis* Shiraki, Acrididen Japans, p. 81, no. 2, tab. ii, figs. 2 *a*, *b*, *c*.
1914. [*Thisoicetrus*] *hokutensis* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, p. 23.

I cannot agree with Bolivar, who placed this species among *Thisoicetrus*, while it has short, narrow and acute cerci. It is true that the number of outer spines on the hind tibiae (11–12) is rather high for an *Euprepocnemis*, but the same number is to be seen in *E. calceata* Serv. *E. hokutensis* seems to be rather closely related to *E. plorans* Charp. (not *plorans* of Shiraki, which is a distinct species, described by Bolivar as *E. shirakii*), but distinguished by a long pronotum, the coloration of the hind tibiae and the number of their spines.

9. **Euprepocnemis shirakii** I. Bol.

1910. *Euprepocnemis plorans* Shiraki (*nec* Charp.), Acrididen Japans, p. 79, no. 1.
1914. *Euprepocnemis shirakii* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, pp. 10, 11.

This is an extremely well-marked species, the chief character being the peculiar shape of the male cerci, which are not short and acute, as in other species of this genus, but are far longer than the anal plate, and have a dilated apex. The affinity of this species to *E. alacris* is shown by the absence of a median carinula on the vertex.

The specimens from China and Baltistan differ from Japanese examples by their smaller size; it is possible

that they represent a distinct geographical race, but more material is wanted to confirm this.

British Museum specimens: Japan, 2 ♂♂; Da-laen-saen, nr. Nong-po (*Walker coll.*), 2 ♂♂; W. China, Chung-King, Sze-Chuen Prov. (*W. A. Maw*), 1 ♀; Baltistan, 1 ♂, 4 ♀♀.

10. Euprepocnemis abyssinica, sp. n.

Light castaneous with brown and grey markings. Frontal ridge strongly narrowed towards fastigium and widened towards clypeus, its margins being obtuse and below ocellum completely smooth. Below the eyes black shining vertical stripes. Fastigium of the vertex rather narrow, subacute, with short, low median carinula expressed only between eyes. Head above with a narrow longitudinal castaneous stripe a little widened posteriorly. Pronotum with a castaneous spot typical of the genus on the disk, the pale marginal stripes being narrow; prozona one and a half times as long as metazona; lateral lobes pale with a blackish elongate spot extending from the anterior margin to the third transverse sulcus, smooth and shining, except the part behind the third sulcus which is rugosely punctured. Prosternal tubercle cylindrical, obtuse, slightly bent towards mesosternum. Mesosternal lobes transverse; their interspace longer than broad. Metasternal lobes contiguous. Mesopleurae with oblique black stripes. Elytra lanceolate, brownish with castaneous radial veins and spots of the same colour along the discoidal field; transverse venulation not dense. Wings yellowish at the base, slightly infumate towards apex. Fore and middle femora incrassate. Hind femora short, incrassate, with two obliterate oblique grey stripes externally and internally; genicular lobes pale with grey upper spot. Hind tibiae proximally pale with two bluish-grey rings, distally sanguineous, armed with 9 outer and 8 inner white spines with black points. Hind tarsi sanguineous above and pale below. Supra-anal plate with a thick raised median ridge, sulcated narrowly in the proximal part; the margins slightly impressed, darkened at the base; cerci thin, acute, slightly incurved and decurved, a little longer than supra-anal plate; subgenital plate obtuse conical, sparsely hairy. The dimensions of the type specimen (♂) are as follows: Length of the body 23 mm.; of pronotum 5 mm.; of elytra 7·5 mm.; of hind femora 13 mm.; of hind tibiae 11 mm.

The dimensions of cotypic ♀ are: Length of body 32 mm.; of pronotum 6 mm.; of elytra 8·5 mm.; of hind femora 17 mm.; of hind tibiae 14 mm.

In spite of the short elytra, this species doubtless belongs to *Euprepocnemis*, as the shape of its meso- and metasternum is characteristic of this genus, but not of *Paracuprepocnemis*, which has also short elytra. The other specimens show no difference in morphological characters and coloration from the above described type.

British Museum specimens: Abyssinia, Zegi Tsana, May–June, 1902 (*Degen*), 3 ♂♂ (*type and cotypes*); Abyssinia, Godsham, Jan. 1902 (*Degen*), 1 ♀ (*cotype*).

Since the identification of species of this genus is rather difficult, I think the following key to those species, known to me (*i. e.* except *senegalensis*, *cinerea*, *hokutensis* and *malagassa*) may be useful:—

1. (14) Elytra fully developed.
2. (11) Vertex with short median carinula.
3. (4) Elytra with sulphurous stripe in axillar field. Transverse venulation of this field, as well as of discoidal, is very dense. Hind tibiae blue with pale ring in proximal half and sanguineous in distal.

   a (*b*) Hind femora but feebly incrassate, without transverse bands on the upperside.—Mediterranean countries.
   E. plorans plorans Charp.

   b (*a*) Hind femora distinctly incrassate with grey transverse bands on the upperside.—South Africa.
   E. plorans meridionalis Uvar.

4. (3) Elytra without sulphurous stripe in axillar field.
5. (6) Hind tibiae unicolorous pale yellowish. Venulation of elytra as in *plorans plorans*.—Africa.
   E. plorans pallida Uvar.
6. (5) Hind tibiae not pale yellowish. Venulation of elytra in axillar and discoidal fields rather sparse; both fields more or less transparent.
7. (10) Hind tibiae blue in proximal part only, distal part being red or sanguineous (in *longipennis* often totally without blue colour), armed with not more than 10 spines outwardly.
8. (9) Elytra in both sexes not or scarcely reaching hind knees.—E. Africa . . . *E. ibandana ibandana* G.-Tos.
9. (8) Elytra reaching hind knees or even longer.—W. Africa.
   E. ibandana longipennis Uvar.
10. (7) Hind tibiae entirely blue with only a small rose spot at the outer side before apex, armed with 12 spines outwardly.—S. Africa . . . . . *E. calceata* Serv.

11. (2) Vertex without median carinula.
12. (13) Hind tibiae brownish-sanguineous or bluish-green. Cerci of the male short, narrow, with an acute apex.—India, Ceylon . . . . . *E. alacris* Serv.
13. (12) Hind tibiae coral-red with two black rings in proximal part. Cerci of the male elongate, recurved, compressed, with widened and rounded apex.—Japan, China, Baltistan . . . . . *E. shirakii* I. Bol.
14. (1) Elytra reduced, reaching about the middle of abdomen.—Abyssinia . . . . . *E. abyssinica* Uvar.

Genus Euprepocnemides I. Bol.

1914. *Euprepocnemides* I. Bolivar, Trab. Mus. Madrid, ser. Zool. N 20, p. 13.

1. Euprepocnemides pictipes I. Bol. ?

1902. *P*[*araeuprepocnemis*] *pictipes* I. Bolivar, Ann. Soc. Ent. Fr., lxx, p. 631.
1910. *P*[*araeuprocnemis* (*sic*)] *pictipes* Kirby, Syn. Cat. Orth., iii, p. 557, no. 2.
1914. *Paraeuprepocnemis pictipes* Kirby, Fauna Brit. India, Acrid., p. 266, no. 327.

The only specimen in the Museum collection is in a very bad condition, and I cannot be sure as to its identification.

British Museum specimen: Coonoor (India), 1 ♀.

Genus Jucundacris, gen. n.

Related to *Euprepocnemis* Fieb., and of its general habitus, but a little more slender. Head rather prominent forwards with strongly reclined face. Frontal ridge with obtuse parallel margins, slightly narrowed above the ocellum, in male slightly impressed at ocellum. Lateral ocelli placed just below the margins of fastigium. Fastigium nearly horizontal, with lateral margins wide and impressedly punctate, with triangular impression which is transverse in female and longer than wide in male. Antennae in male scarcely reaching the hind margin of the pronotum, in female shorter, in both sexes filiform, in male only slightly widened beyond the middle. Pronotum compressed, rather elongate, with lateral keels very obtuse in prozona and disappearing in metazona, with low, but acute median carina; metazona a little shorter than prozona. Prosternal tubercle cylindrical, rather thick, with obtusely rounded apex, inclined towards the mesosternum. Mesosternal

lobes in male nearly quadrate with inner margins arched and interspace $2\frac{1}{2}$ times as long as wide in its middle; in the female the said lobes are of the same form, with interspace twice as long as its width in the middle; metasternal lobes contiguous in male and distant in female. Male anal plate lanceolate, rotundate at the apex; cerci longer than this plate, compressed laterally, with parallel sides and acute apex, incurved at their middle and bent downwards before apex; subgenital plate short, but longer than cerci, very obtuse, hairy. Fore and middle femora thickened in male. Hind femora narrow, slender, with one series of bracket-shaped black spots both on outer and inner side. Hind tibiae slightly widened towards apex, with rounded keels, armed with 9–11 spines outwardly and 9–10 inwardly, without outer apical spine. Hind tarsi with second joint very short.

Genotype: *Cyrtacanthacris pictipes* Walk.

1. **Jucundacris pictipes** Walk.

1870. *Cyrtacanthacris pictipes* Walker, Cat. Derm. Salt. B.M., iii, p. 575, no. 51.
1907. [*Acridium*] *pictipes* Finot, Ann. Soc. Ent. Fr., lxxvi, p. 328, no. 56.
1910. *E*[*uprepocnemis*] *pictipes* Kirby, Syn. Cat. Orth., iii, p. 561, no. 9.
1914. *Thisoecetrus jucundus* Carl, Rev. Suisse Zool., 24, p. 496, pl. 2, fig. 15.
1914. *Thisoecetrus hottentotus*, I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, p. 29.

This handsome insect has been recently described by Bolivar and by J. Carl (l. c.); the latter author mentions some of its striking characters which give it a rather isolated position amongst species of *Thisoicetrus*, where he placed it. The structure of antennae and sternum shows clearly that it is nearer to *Euprepocnemis*, but the peculiar shape of the male cerci, the type of coloration of the hind femora, as well as the form of the inner margins of the mesosternal lobes, are characteristic enough to base a new genus on them. The description of the species given by Carl is so precise that it allows me undoubtedly to conclude that his *T. jucundus* is identical with Walker's *Cyrtacanthacris pictipes;* the probability of such identity has been supposed by Dr. Carl himself, though with some doubt; this is quite easy to understand in view of the recognised unsatisfactory character of Walker's descriptions. The small difference

in dimensions between Walker's and Carl's specimens is of no systematic importance.

British Museum specimens: South Africa, 1 ♀ (*Walker's type*); Pretoria (*W. L. Distant*), 2 ♂♂; Johannesburg (*J. P. Cregoe*), 1 ♀ (the three latter specimens bear Kirby's determination as *Euprepocnemis pictipes* Walk.); Johannesburg (*A. Ross*), 1 ♂.

Genus Thisoicetrus Br. Watt.

I am in complete agreement with Dr. Bolivar in delimitating this genus, which is quite a natural one. In fact, it has nothing to do with *Euprepocnemis*, though, on the other hand, it is very closely related to *Heteracris* in Bolivar's restricted sense.

The number of species of *Thisoicetrus* described by different authors is rather large, and I am compelled to describe several more new ones, mostly African, though I leave without description yet more apparently new forms which are represented by badly preserved specimens or by females only.

1. Thisoicetrus littoralis (Ramb.).

Bolivar considers that *T. littoralis* Ramb., and *T. charpentieri* Stal, are two different species, the only distinction being in the number of spines on the hind tibiae. A study of every species of *Thisoicetrus* shows most clearly that this character is rather inconstant, and it is quite easy to find specimens with a different number of spines on the right and left tibiae. I am convinced, therefore, that *T. charpentieri* is a mere synonym of *T. littoralis*. Kirby in his Catalogue (iii, p. 558, no. 6) has given the full synonymy of this species, and I consider it superfluous to repeat it here; I should like to add, however, the following new synonyms :—

1861. *Caloptenus similis* Brunner v. Wattenwyll, Verh. Zool. Bot. Ges. Wien, xi, p. 224.
1870. *Heteracris annulosa* Walker, Cat. Derm. Salt, B.M., iv. pp. 673, 674, no. 41.
1871. *Acridium continuum* Walker, l.c., v, Suppl., p. 61.
1905. *Caloptenus similis* Jacobson and Bianchi, Priamokr. i Lozhnoset. Ross. Imp., p. 319.
1907. [*Acridium*] *continuum* Finot, Ann. Soc. Ent. Fr., lxxvi, p. 342.

1910. *H*[*eteracris*] (?) *continua* Kirby, Syn. Cat. Orth., iii, p. 555, no. 11.
1910. *E*[*uprepocnemis*] *annulosa* Kirby, l.c., p. 560, no. 4.
1912. *Th*[*isoccetrus*] *similis* Uvarov, Horae Soc. Ent. Ross. xl (3), p. 32, no. 85, fig. 3*c*.
1912. *Euprepocnemis littoralis* Uvarov, l.c., p. 34, no. 87.
1914. [*Thisoecetrus*] *similis* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, p. 23.

British Museum specimens: Upper Egypt, 1 ♀ (*type of Cyrtacanthacris notata* Walk.); St. Vincent, Cape Verde Is., 1896, 1 ♀; Somali, 1 ♀; Biskra, 22 ii. 1895, 1 ♂, 1 ♀; Bushire, 2 ♀♀; Rhodos, 1 ♂, 1 ♀; Hadramaut, Arabia, 2 ♀♀; Quetta, 1 ♀; Mount Sinai, 1 ♀ (*type of Acridium continuum* Walk.); 1 ♀ without locality (*type of Heteracris annulosa* Walk.); Cyprus, Larnaca, 1 ♀ (*C. Glazner*); Baluchistan, Ormarah (*W. D. Cumming*), 1 ♀; Kharga Oasis, Egypt, Feb. 1912, 1 ♂; Chor-es-Saflah, Dead Sea, 1 ♀ (bearing inscription on the label: "Hart N. 57"); Algeria, Biskra (*W. J. H. King*), 2 ♂♂, 2 ♀♀.

1*a*. **Thisoicetrus littoralis** var. **minuta** n.

Three specimens in the Museum collection (2 ♂♂ and 1 ♀) from Bône, Algeria, differ from typical form by their very small dimensions, all other characters being in complete accordance with specimens from other localities. I think that they represent a distinct geographical race, though the specimens from Biskra (not very far from Bône) are of the usual dimensions. Still, the difference is so striking that I believe it to be useful to give the dimensions of this small form, while I hope that further investigations of Algerian specimens will make clear its taxonomic position. The male type has the following dimensions: Length of body 16 mm.; of pronotum 3 mm.; of elytra 13 mm.; of hind femora 10 mm. The dimensions of the female cotype are: Length of body 27 mm.; of pronotum 4·5 mm.; of elytra 21 mm.; of hind femora 15 mm.

British Museum specimens: Algeria, Bône, 21 ix. 1896 (*A. E. Eaton*), 2 ♂♂, 1 ♀ (*one male being the type, another and one female cotypes*).

2. **Thisoicetrus adspersus** (Redt.).

1889. *Euprepocnemis adspersa* Redtenbacher, Wien. Ent. Ztg. viii, p. 30.

1898. *Th*[*isoicetrus*] *adspersus* I. Bolivar, Ann. Sci. Nat. Porto, v, pp. 34, 35, no. 2.
1905. *Th*[*isoecetrus*] *adspersus* Jacobson and Bianchi; Priam. i Lozhnoset. Ross. Imp., pp. 205, 319.
1910. *T*[*hisoicetrus*] *adspersus* Kirby, Syn. Cat. Orth., iii, p. 559, no. 4.
1912. *Th*[*isoecetrus*] *adspersus* Uvarov, Horae Soc. Ent. Ross., xl (3), pp. 33, 34, fig. 3*c*.

British Museum specimens: Spain (*I. Bolivar*), 2 ♂♂, 2 ♀♀.

3. Thisoicetrus buxtoni Uvar.

1921. *Thisoecetrus buxtoni* Uvarov, Journ. Bomb. Nat. Hist. Soc. (in course of publication).

British Museum specimens: Mesopotamia, Masharra Canal, Amara, 8 vi. 1918 (*W. E. Evans*), 1 ♂ (*type*); Amara (*P. A. Buxton*), 1 ♂ (*cotype*).

4. Thisoicetrus pulchripes pulchripes (Schaum).

1853. *Caloptenus pulchripes* Schaum, Ber. Akad. Berlin, 1853, p. 779, no. 21.
1862. *Caloptenus pulchripes* Schaum, Peters Reise Mozamb., Zool., v, p. 138, pl. 7. A., fig. 7.
1910. *E*[*upropocnemis*] *pulchripes* Kirby, Syn. Cat. Orth., ii, p. 561, no. 8.
1917. [*Thisoicetrus*] *pulchripes* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, p. 23.

British Museum specimens: S. Rhodesia, Chirinda Forest (*C. F. M. Swynnerton*), 2 ♂♂; Salisbury, Mashonaland (*G. A. K. Marshall*), 1 ♂, 2 ♀♀; Mt. Chirinda, Gaza Land, Nov.–Dec. 1906 (*D. Odendaal*), 1 ♀; Fort Johnston, Nyasaland (*P. Rendall*), 1 ♀.

The female specimen from Fort Johnston has short elytra, scarcely extending beyond the apex of abdomen. Males, which have not previously been described, completely agree in all morphological characters with *T. guineensis* Kr., as well as with *T. jeanneli* Bol., and I cannot regard the two latter species as well as *T. coerulipes* Sjöst., and *T. nigrovittatus* Bol., as anything else than local colour forms of one species. This, in my opinion, is confirmed by the occurrence of some transitional forms between these. Thus the ab. *coeruleipennis* of *T. pulchripes*, described below,

being morphologically identical with *T. pulchripes* and *T. jeanneli*, has light blue wings, as in the latter species, and violet tibiae—of a shade intermediate between the two. Two specimens (♂ and ♀) of *T. guineensis* from Sierra Leone are quite indistinguishable from Uganda specimens, except that their wings are light orange at their base and strongly infumated towards the apex; they are very close to the true *T. pulchripes*. I believe that the whole of Tropical and South Africa is inhabited by the one species—very variable in the coloration of the wings and hind legs, as well as the head (but not in morphological characters)—*T. pulchripes*, which may be divided into many geographical races, connected by transitional forms. These races have been described by different writers as distinct species, and I believe that the following should be included in *pulchripes*, as subspecies of it only :—

coerulipes Sjöstedt, 1913.
guineensis Krauss, 1891.
„ var. *maculosa* Krauss, 1891.
nigrovittatus I. Bolivar, 1914.
jeanneli I. Bolivar, 1914.

Some of these, after careful investigation and examination of large series of specimens from different localities, may even prove to be mere individual aberrations of the same subspecies. More material is certainly wanted to confirm this opinion, but I think it more useful to raise the question in this form than to describe every colour variety as a distinct species.

4*a*. **Thisoicetrus pulchripes** ab. **coeruleipennis** n.

The only differences of this form from the typical one consist in the coloration of the wings, which are light blue at the disk and slightly infumated towards their apex, and in the coloration of the hind tibiae, which are not sanguineous in the distal part, as in the typical form, but more violaceous. I believe this form to be a kind of link between the subspecies *pulchripes* and *jeanneli*.

British Museum specimen : Barberton, 1 ♂ (named by Kirby, as *Euprepocnemis pulchripes*).

4*b*. **Thisoicetrus pulchripes jeanneli** I. Bol.

1914. *Thisoicetrus jeanneli* I. Bolivar, Trab. Mus. Madrid, Ser. Zool., N 20, p. 26.

I think that this is very closely related to *coerulescens* Stäl, and perhaps even identical with it. The difference between it and *T. nigrovittatus*, described by Bolivar in the same paper (l.c. p. 25), is not clear to me.

British Museum specimen: German E. Africa, 1 ♂.

4c. **Thisoicetrus pulchripes guineensis** (Krauss).

1891. *E*[*uprepocnemis*] *guineensis* Krauss, Zool. Jahrb., Syst., v, p. 659, no. 14, pl. 45, fig. 5.
1891. *E*[*uprepocnemis*] *guineensis* var. *maculosa* Krauss, l.c. p. 660, pl. 45, figs. 6, 6*a*.
1907. *E*[*uprepocnemis*] *guineensis* Giglio-Tos, Bol. Mus. Torino, xxii (554), p. 30.
1910. *E*[*uprepocnemis*] *guineensis* Kirby, Syn. Cat. Orth., iii, p. 560, no. 7.
1914. [*Thisoicetrus*] *guineensis* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, p. 23.
1914. *Thisoicetrus guineensis* Sjöstedt, Ark. Zool., 12 (1), p. 14.

British Museum specimens: Uganda: Entebbe, Bonda, Chagwe, Mityana, Kampala, Mabira Forest, 14 ♂♂, 8 ♀♀ (*C. C. Gowdey*).

I quite agree with Giglio-Tos that var. *maculosa* is only an individual aberration. All specimens examined by me have the wings of a very pale buff colour, not hyaline.

4d. **Thisoicetrus pulchripes aurantiaca** subsp. nov.

Two specimens (1 ♂, 1 ♀) from Sierra Leone, though quite like *pulchripes* in morphological characters, are distinct in coloration of hind tibiae: these are not sanguineous, but red, as in *T. guineensis*, while the wings are orange, as in typical *pulchripes;* the elytra are marked with rather large black spots, forming transverse bands.

British Museum specimens: Sierra Leone, Kayima, 25 vi. 1912, 1 ♂ (*type*), Bendu, 14 viii. 1912, 1 ♀ (*cotype*) (*J. J. Simpson*).

5. **Thisoicetrus usambaricus** I. Bol.

1914. *Thisoicetrus usambaricus* I. Bolivar, Trab. Mus. Madrid, ser. Zool. N 20, p. 27.

I regard this species as being distinct from *T. pulchripes*, though rather near to it. The chief difference is in the form of the wings, which are very wide, and, further, are

not at all infumated towards the apex, a character that is always present in all forms of *T. pulchripes*. The male genitalia are quite like those of *T. pulchripes*.

British Museum specimens: Entebbe, Uganda (*C. C. Gowdey*), 4 ♂♂, 1 ♀; Mabira Forest, Uganda (*C. C. Gowdey*), 1 ♀.

6. Thisoicetrus pulcher (I. Bol.).

1902. *E*[*uprepocnemis*] *pulchra* I. Bolivar, Ann. Soc. Ent. Fr., lxx, p. 630.
1910. *E*[*uprepocnemis*] *pulchra* Kirby, Syn. Cat. Orth., iii, p. 561, no. 17.
1914. [*Thisoicetrus*] *pulcher* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, p. 23.
1914. *Euprepocnemis pulchra* Kirby, Fauna Brit. India, Acrid., p. 268, no. 329.
1918. *Thisoicetrus pulcher* I. Bolivar, Rev. Real Acad. Cien. Madrid, xvi, seg. ser., p. 411, no. 103.

British Museum specimens: Ceylon (*E. E. Green*), 2 ♂♂, 2 ♀♀; Turicomabe, Ceylon, Sept. 1909, 1 ♀ (named by Kirby, *Euprepocnemis alacris* Serv.); Simpson (?), 1 ♀; India, 2 ♂♂.

This species, though known from India, has not been recorded previously in Ceylon. Two males from India are remarkable for the very light sulphurous longitudinal stripes on the occiput, pronotum and elytra, as well as similarly coloured sides of the head (except brown stripes below the eyes); in addition, the median castaneous stripe of the pronotum in these specimens, as well as in one female from Ceylon, is not faded in its middle, as it usually occurs in typical specimens.

7. Thisoicetrus attenuatus, sp. n.

The general habitus and coloration of this new species resemble very much those of *T. pulchripes* Schaum. Head very prominent upwards with globose occiput; front strongly reclinate, frontal ridge flat, punctured, with smooth margins, parallel below the ocellum, slightly widened and again gradually narrowed towards the fastigium; fastigium very prominent, nearly horizontal and very slightly impressed; face greenish-yellow with wide black band from labrum to fastigium, the lateral carinae of the frontal ridge being yellow; cheeks totally black, except an oblong yellowish-green patch adjoining the hind margin of the eyes; vertex and occiput with

black fascia, widening posteriorly. Pronotum with metazona nearly twice as short as prozona; prozona slightly tectiform, metazona flat; lateral carinae straight, parallel, in metazona obliterate; median carina raised, acute; disk with a black parallel longitudinal fascia and two greenish-yellow lateral bands; lateral lobes coriaceous, totally black. Prosternal tubercle compressed from fore and hind side, with obtuse rotundate apex. Elytra dark brown, except green anal area, reaching the apex of the abdomen, with straightly truncate apex. Wings totally infumated. Fore and middle legs olivaceous. Hind femora with the basal half outwardly olivaceous, becoming black towards the middle, in the apical half with two yellow transverse bands, divided by a black one; the knee totally black; inner side of femora yellowish-green with two black transverse bands and black apex. Hind tibiae with black base, followed by a yellow ring, which is delimitated by another, less defined black ring; the apical half and tarsi sanguineous. Anal segment (♂) with two short widely standing processi. Supra-anal plate rotundate triangular with the apex subacute, with a short and rather wide longitudinal sulcus at its base. Cerci longer than supra-anal plate, compressed, beyond the middle widened and rather suddenly decurved, with rounded apex. Subgenital plate with its apex attenuate vertically, obtuse and bearing two very low tubercles. Length of the body (♂ type) 22 mm.; of pronotum 4·5 mm.; of elytra 13·5 mm.; of hind femora 15 mm.

The prominent head, the shape of pronotum, shortness and form of the apex of elytra, and, especially, the peculiar form of the subgenital plate are the chief characters of this remarkable species, which is unfortunately represented by one male specimen only.

British Museum specimen: Fwambo, British Central Africa (*A. Carson*), 1 ♂ (*type*).

There is in the Museum collection another species (from Nyasaland), the male of which is also very attenuate at the apex of the subgenital plate, without two tubercles on it, which is doubtless new, but I abstain from describing it, since it is represented by two (♂ and ♀) very badly preserved specimens, almost totally decolorated by alcohol.

Genus Thisoicetrinus, g. n.

Thisoicetrus dorsatus F.-W., differs from all other species of the genus *Thisoicetrus* in having the antennae very long, the pronotum strongly rounded without any trace of lateral carinae and the male subgenital plate, not short and obtuse,

but long, attenuate and acute. I propose, therefore, to separate it into a new genus *Thisoicetrinus* with the above characteristic and select *Acridium dorsatum* F.-W. as the genotype.

8. **Thisoicetrinus dorsatus** (F.-W.).

1839. *A*[*cridium*] *dorsatum* Fischer de Waldheim, Bull. Soc. Imp. Nat. Moscow, p. 301.
1853. *Euprepocnemis fischeri* Filber, Lotos, iii, p. 98, no. 7.
1876. *Calliptamus dorsatus* Fischer de Waldheim, Orth. Imp. Ross., p. 240, pl. 19, f. 2 (♀ !).
1876. *Calliptamus pterosticha* Fischer de Waldheim, l.c., p. 244, pl. 16, f. 4 (♂).
1910. *T*[*hisoicetrus*] *dorsatus* Kirby, Syn. Cat. Orth., iii, p. 559, no. 2.
1912. *Thisoecetrus dorsatus* Uvarov, Horae Soc. Ent. Ross., xl, N 3, p. 32, no. 84, fig. 3*a*.
1914. [*Thisoicetrus*] *pterostichus* I. Bolivar, Trab. Mus. Madrid, ser. Zool. N 20, p. 23.
1914. [*Thisoicetrus*] *dorsatus* I. Bolivar, l.c., p. 23.

The correct synonymy of this species was established by me after studying Fischer de Waldheim's type specimens in 1912, but Bolivar, in his recent revision of this group, has overlooked it and regarded *T. pterostichus* and *T. dorsatus* as two distinct species.

British Museum specimens: Armenia (*F. Ostwald*), 1 ♀ (bearing Kirby's label: "*Euprepocnemis punctata* Kb. type"; this name has never been published); S. Russia, Astrakhan (*N. L. Sakharov*), 1 ♀; N. Persia: Chanigin, Diala R. (*P. Buxton*), 1 ♀.

Genus Thisoicetrellus, g. n.

Closely related to *Thisoicetrus*. Antennae (♂) reaching beyond the hind border of pronotum, flattened and slightly dilated in the middle. Frontal costa flat, slightly impressed below ocellum, strongly punctured, with lateral carinae smooth, parallel, very slightly divergent and disappearing towards the clypeus, strongly convergent to the vertex. Lateral ocelli placed near lateral margins of vertex. Fastigium of the vertex prominent with slight rhombiform impression, without median keel. Pronotum with three keels, as in *Thisoicetrus;* prozona one and a half times as long as metazona; hind margin widely rounded. Prosternal tubercle compressed in front and from behind, with lateral margins straight and parallel,

with apex truncate and slightly bituberculate at the front side. Mesosternal lobes transverse with interspace quadrate. Metasternal lobes non-contiguous. Elytra short, reaching to about the middle of abdomen. Wings coloured with apex dark. Abdomen (♂) with apex strongly recurved and inflated; anal segment very large; supra-anal plate large, oblong, gradually narrowed towards the apex, sulcate in basal half, low incrassate margins of the sulcus strongly diverging beyond its middle. Cerci, as in *Thisoicetrus*, strongly compressed, especially in the apical part, where they are bent downwards, with apex widely rounded. Subgenital plate very short, globose. Hind femora rather slender. Hind tibiae with nine outer and nine inner spines. Hind tarsi as in *Thisoicetrus*.

Genotype: *Thisoicetrellus recurvus*, sp. n.

This genus strongly resembles *Thisoicetrus* in all its characters, but is distinguished by the extraordinarily recurved and inflated apex to the abdomen, the shortness of the elytra and the form of the prosternal tubercle.

1. Thisoicetrellus recurvus, sp. n.

♂. Blackish olivaceous, with yellowish-green and black design. Antennae pale brownish. Face pale; frontal ridge olivaceous with blackish points; sides of the head behind the infraocular sulci black; vertex brownish, with not sharply defined blackish median stripe included between two lateral yellowish-green stripes. Pronotum with wide median stripe which is castaneous in its middle and blacker towards the margins; lateral stripes narrow, greenish-yellow; lateral lobes blackish olivaceous. Elytra brownish olivaceous, except yellowish-green anal field. Wings yellowish with fore margin infumate towards the apex. Sternum and abdomen olivaceous. Cerci dark brown with apical part light brown. Hind femora outwardly and inwardly reddish in basal half with an indistinct dark band in the middle, yellow in apical half with an ill-defined dark transverse band before the black knee; the lower sulcus sanguineous. Hind tibiae black, with orange ring near the base; spines white with black tips. Hind tarsi brown.

Length of body (*i. e.* from the fastigium of vertex to the apex of subgenital plate in normal recurved condition of abdomen) 17 mm.; of pronotum 4 mm.; of elytra 6 mm.; of hind femora 12·5 mm.

British Museum specimen: Kavaluki valley, British E. Africa (*Gregory* coll.), 1 ♂ (*type*).

Genus Bibulus I. Bol.

1. **Bibulus brunni** (Gig.-Tos).

1901. *Eu[prepocnemis] coerulescens* Brunn (*nec* Stal?); Mitt. Naturhist. Mus. Hamburg, xviii, p. 264, no. 132.
1907. *T[ylotropidius] brunni* Giglio-Tos, Boll. Mus. Torino, xxii, 552, p. 31.
1914. *Bibulus brunni* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, p. 31.

I am still not quite sure that *coerulescens* Stal is actually distinct from *brunni;* a definite solution of this question is possible only by examining Stâl's type.

British Museum specimens: British E. Africa (*C. S. Betton*), 1 ♀; Sokotra, 1 ♀ (bearing M. Burr's label: "*Cataloipus oberthüri* Bol.").

2. **Bibulus desertus,** sp. n.

General coloration light buff. Face reclinate; frontal ridge flat, punctured, with very slightly raised lateral carinae, a little narrowed towards clypeus and more distinctly, but still feebly, narrowed towards fastigium. Fastigium of the vertex rotundate, with oval impression and low, acute median carinula, which is more raised between the eyes. Occiput unicolorous with but slight trace of brownish spot before the middle of the hind margin. Antennae of general colour above and blackened in distal two-thirds below, slightly widened beyond the middle, a little longer than head and pronotum taken together. Pronotum with a narrow chocolate-brown longitudinal band, which gradually widens backwards, rather suddenly narrows in metazona, its width at the fore margin being a little less than that at the hind margin and half the width of the widest portion, which is in the middle of metazona; marginal parts of the band are more intensely coloured than its interior part; lateral bands of pronotum are light buff, their width at the fore margin being equal to the width of median stripe, while they are widened in the hind half of metazona; the whole disk of pronotum is not flat but slightly tectiform with a raised median carina, which is deeply interrupted by three transverse sulci; prozona distinctly longer than metazona; hind margin obtusely angulate; lateral lobes unicolorous, coriaceous throughout but more densely in metazona. Prosternal tubercle flattened anteriorly, with wide truncate apex. Elytra longer than abdomen, with all veins, except in the anal field, brownish, with indistinct brownish transverse bands. Wings bluish hyaline, slightly infumated towards their apex. Hind

femora without any markings outwardly, but with two shining black spots inwardly, one occupying the whole basal half and another, smaller one, placed at the beginning of narrow part of the femur; knees black with brown lobes. Hind tibiae pale with three black rings, one at the base and two at equal distances from one another, the third being indistinct from above; the number of spines is 11 at the outer margin and 13 at the inner. Anal segment with two short non-contiguous appendages in the middle. Supra-anal plate oval, with middle part raised at the base and with short median sulcus; its lateral margins with two inflexions and suddenly inflexed towards the middle before the apex; the apex itself attenuate in short obtuse processus. Cerci longer than supra-anal plate and as long as subgenital plate, compressed, towards the apex slightly widened and slightly bent downwards. Subgenital plate conical, obtuse, hairy.

The dimensions of the type (♂) are: Length of body 22 mm.; of pronotum 5 mm.; of elytra 20 mm.; of hind femur 15 mm.

The female cotypes are much larger than the males, and differ in coloration of cheeks, of lateral lobes of the pronotum and of the pleurae, which are marked with numerous irregular dark grey and black spots and points; the hind femora also have numerous obliterate grey points in area externomedia and three obliterate greyish transverse bands at the upper side, prolonged to the inner side; hind tibiae are light greyish-slate, with white, black-pointed spines. Dimensions of the female are: Length of body 42 mm.; of pronotum 9 mm.; of hind femora 27 mm.; of elytra 33 mm.

This species is closely related to *B. brunni*, but differs from it in its coloration, its shorter and narrower elytra (especially in the females) and shorter hind femora. The sexual dimorphism in this species is also very striking, as it is in *B. brunni*.

British Museum specimens: Arabia (*Percival and Dodson*), 1 ♂ (*type*); Arabia, Ktubu (*G. W. Bury*), 2 ♀♀; Somali, 1 ♂ (*the three latter specimens being cotypes*).

Genus Horaeocerus Sauss.

1. Horaeocerus antennatus I. Bol.

1914. *Horaeocerus antennata* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, p. 30.

British Museum specimen: Madagascar, 1 ♀.

Genus Heteracris Walk.

I completely agree with I. Bolivar in his restricted treatment of this genus (Trab. Mus. Madrid, ser. Zool., N 20, pp. 19–20), but it seems to me rather doubtful whether the specimens that served Bolivar as types of his (not Serville's) *H. herbacea* are actually identical with *herbacea* Serv., because Sjöstedt, who examined Stal's specimens of *herbacea*, stated (Ark. Zool., viii, 6, p. 24) that the cerci of *herbacea* are "an der Spitze ziemlich kurz und breit verengt," while Bolivar's description says: "cerci ♂ compressi apicem versus sensim attenuati, sinuati, apice acutiusculi." A comparison of these two descriptions and Stal's diagnosis of *herbacea:* "cercorum maris ad *P. charpentieri* appropinquat," show clearly that Bolivar's specimens are not Stal's *herbacea*, though it is quite possible that the latter is not identical with *herbacea* Serv., which is described from the female only; and the females in this genus are extremely alike each other. If we accept Stal's description and his male specimens as true *herbacea* Serv., then Bolivar's diagnosis of this genus ought to be slightly altered in so far as it is based upon the form of the male cerci. In fact, it seems that a definite separation line between *Thisoicetrus* and *Heteracris* (in Bolivar's meaning) can hardly be drawn, since the other very important character of *Heteracris*—the relative shortness of metazone of the pronotum—is to be seen in *Thisoicetrus attenuatus* Uvar. (see above), in which the cerci are rounded apically. Still I think it useful to retain the genus *Heteracris* for the present, but its full revision, based upon type specimens and ample new material, is extremely necessary.

The number of species of this genus is very small; of the numerous Walker's species described under this genus, none but *herbacea* (*nec* Serv.) belongs here; Walker named three different species as *herbacea*, two of them being described below as new. *Acridium herbaceum* Serv., which belongs here, might be identical with *speciosa* Sjöst., but must be regarded for the present as distinct, the total number of species being thus four; three of them are represented in the Museum collection.

1. **Heteracris speciosa** (Sjöst.).

1870. *Heteracris herbacea* Walker (*nec* Serv.), Cat. Derm. Salt. B.M., iv, p. 656, no. 3 (*partim*?).

1913. *Euprepocnemis speciosa* Sjöstedt, Ark. Zool., viii (6), p. 23, pl. 1, fig. 3.
1916. *Thisoicetrus speciosus* J. Carl, Revue Suisse Zool., 24 (6), p. 494, pl. 2, fig. 13.

It is quite possible that *H. speciosa* is identical with *H. herbacea* Serv., of which only the female was described.

British Museum specimens: Pt. Natal, 1 ♂, 2 ♀♀; S. Africa, 1 ♂ (all labelled by Walker as *H. herbacea* Serv.).

2. **Heteracris acuminata,** sp. n.

1870. *Heteracris herbacea* Walker, Cat. Derm. Salt. B.M., iv, p. 656, no. 3 (*partim?*).
1914. *Heteracris herbaceus* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N 20, p. 21.

In coloration and all morphological characters quite like *H. speciosa*, the only difference being in the form of the male cerci, which are prolonged into very acute long spines. In the male cotype this spine is shorter and less acute; in the type specimen also the right cercus has this spine shorter than the left one. The females are not separable from those of *H. speciosa*. Dimensions of male type are: Length of body 27 mm.; of pronotum 6 mm.; of elytra 20 mm.; of hind femora 18 mm. One of female cotypes has the following dimensions: Length of body 44 mm.; of pronotum 8 mm.; of elytra 26 mm.; of hind femora 25 mm.

The difference in the form of cerci in the two male specimens is rather striking, and I should describe them as two distinct species but for the fact that nearly the same difference may be seen between the right and left cercus of the type. It is possible that Bolivar has described this species under *Heteracris herbacea* Bol. (*nec* Serv.).

British Museum specimens: Eureka, Barberton (*J. Rendall*), 1 ♂ (*type*); Natal, March 1867, 1 ♂ (labelled by Walker as *H. herbacea* Serv.); Johannesburg, 1 ♀; without date, 1 ♀ (*the three latter are cotypes*).

3. **Heteracris calliptamoides,** sp. n.

In habitus very like a representative of the Calliptamini, the head being rather thick and hind femora short.

Front strongly reclinate; frontal ridge wide, slightly convex, without any trace of sulcus, with sides parallel, disappearing before clypeus. Fastigium of vertex in the male type specimen broken

(in the female cotype it is thick, distinctly transverse, with slight double impression, with lateral margins very thick). Eyes large, prominent. Antennae reaching beyond hind margin of pronotum, markedly dilated in the middle. Pronotum rugosely punctured, with lateral carinae scarcely perceptible in prozona and entirely lacking in metazona; median carina slightly raised, shining; hind margin very widely rounded, nearly straight; lateral lobes strongly impressedly punctate, with lower margin widely rounded. Prosternal tubercle nearly cylindrical, only slightly compressed from behind with obtuse apex. Elytra narrow. Hind femora short and thick. Hind tibiae with 10 spines inwardly and 11 outwardly. Supra-anal plate lancet-shaped with the apex attenuate, with two lateral emarginations, slightly impressed, with short basal median sulcus. Cerci longer than supra-anal plate, wide, compressed, with apical half strongly flattened and bent downwards; apex subacuminate. Subgenital plate short, globose.

General coloration (the specimen is rather discoloured and dirty) is dull brown. Face pale, with cheeks behind the black infra-ocular sulci blackish; eyes pale. Pronotum unicolorous dull brown. Elytra hyaline (in living specimens greenish?), with numerous square brown spots; anal area unicolorous brownish. Wings bluish with their apex slightly infumate. Hind femora reddish, with indistinct dark transverse bands; one yellow ring before the black knee. Hind tibiae greenish-brown, with brown base, yellow basal ring and another less defined light-coloured ring in the middle; spines with brown tips. Length of body (♂ type) 22 mm.; pronotum 4·5 mm.; elytra 14·5 mm.; hind femora 15 mm.

The female cotype differs from the male in having hind femora brownish, with more conspicuous oblique transverse bands; I believe that the reddish colour of femora in the male specimen is abnormal.

British Museum specimens: South Africa, 1 ♂ (*type*); South Africa (*Dr. Smith*), 1 ♀ (both are named by Walker *Heteracris herbacea* Serv.).

Genus Tylotropidius Br. Watt.

The systematics of the species of this genus are in a hopeless state, since nobody has re-examined Stål's and Thunberg's types of the genotypic species (*didymus* Thunb.), and the descriptions given by the authors quoted are not satisfactory. The short revision of species given lately by A. v. Schulthess is also of very little use, since he has not seen typical specimens, and, in consequence, his

didymus is most certainly not the species so named by Thunberg and Stål (see below). I. Bolivar has recently made an attempt to divide this genus into two, and described the new genus *Tropidiopsis*, to which some species of *Tylotropidius* ought to be transferred, but he himself has not given lists of species belonging to the one and the other of these genera.

In consequence I am not quite certain of all my identifications of the species in the Museum collection.

1. Tylotropidius speciosus (Walk.).

1870. *Heteracris speciosa* Walker, Cat. Derm. Salt. B.M., iv, p. 661, no. 12 (*larva*).

1899. *T*[*ylotropidius*] *didymus* Schulthess (*nec* Thunb., *nec* Stål). Bull. Soc. Vaud. Sc. Natur., xxxv, pp. 210–212, figs. 1, 1*a*.

It is evident that Schulthess described and figured in his revision not the species that Stål described as *didymus* Thunb., on the ground of Thunberg's type, though Schulthess himself says that he knows the species personally. That I am correct in this view may be proved by mere comparison of Stål's description with the figure of pronotum given by Schulthess; the lateral keels of pronotum in this figure are quite straight, while Stål says: "marginibus lateralibus a basi primum leviter, dein ante medium fortius convergentibus," *i. e.* the keels are by no means straight in true *didymus*.

The correct name for the species figured by Schulthess as *didymus* (and doubtless so identified by some later writers) is *speciosus* Walk., since Walker's type of *Heteracris speciosa*, though a larva in the last instar, undoubtedly belongs to it.

British Museum specimens: Sierra Leone, 1 ♀ larva (*Walker's type*); Uganda: Entebbe, Bweya, 15 ♂♂, 29 ♀♀ (*C. C. Gowdey*); Uganda, Busoga, Kamuli (*H. Mathers*), 1 ♂; Uganda, Parder distr. (*W. P. Lome*), 1 ♀.

2. Tylotropidius varicornis (Walk.).

1870. *Heteracris varicornis* Walker, Cat. Derm. Salt. B.M., iv, p. 667, no. 25.

1893. *Tylotropidius ceylonicus* Brunner Watt., Ann. Mus. Civ. Gen. xxxiii, p. 164, pl. v, fig. 57.

1910. *E[uprepocnemis] varicornis* Kirby, Syn. Cat. Orth., iii, p. 561, no. 16.
1914. *Tylotropidius varicornis* Kirby, Fauna Brit. India, Acrid., p. 265, no. 326, fig. 140.

British Museum specimens : South Hindostan, 1 ♂ (*Walker's type*); High Range, May 1891, 1 ♀; Ceylon, 2 ♀♀ (*E. E. Green*).

3. **Tylotropidius gracilipes** Brancs. ?

1896. *Tylotropidius gracilipes* Brancsik, Jahresh. Ver. Trencs. Com., xvii–xviii, p. 256, pl. 8, fig. 8.
?1898. *Tylotropidius somalicus* Schulthess, Ann. Mus. Civ. Genova, xxxix, p. 195, no. 1.
1902. *Heteracris bettoni* Kirby, Proc. Zool. Soc. London, (1), p. 100, no. 22.

British Museum specimens : Baringo, 4000 ft., 20 xii. 1909 (*H. H. Johnston*), 3 ♂♂, 1 ♀; Maungu, British E. Africa (*Betton*), 1 ♀; Thika-Thika, Brit. E. Africa (*Gregory*), 1 ♀; Mombasa (*Dr. J. Wilson*), 1 ♀; Atbara, Abyssinia, 1 ♀ (*all eight specimens are Kirby's types of H. bettoni*); Portug. E. Africa, Busi River, Dec. 1906 (*C. F. M. Swynnerton*), 4 ♀♀; Brit. Centr. Africa (*A. R. Andrew*), 1 ♂, 4 ♀♀; Liberia (*W. P. Lowe*), 1 ♀; Oban Distr., S. Nigeria (*P. A. Talbot*), 1 ♂; Delagoa, 1 ♂, 3 ♀♀; Zomba, Feb. and March 1896 (*A. Whyte*), 2 ♀♀; Fort Johnston, Nyasaland, 1 ♀; Mt. Chirinda, Gaza Land, Nov.–Dec. 1906 (*D. Odendaal*), 2 ♀♀; Brit. E. Africa, Narossura R. (*W. P. Lowe*), 1 ♀; Salisbury, Mashonaland (*G. A. K. Marshall*), 2 ♂♂, 1 ♀; Abyssinia, Zegi Tsana, May–June 1902 (*Degen*), 1 ♀; Mombasa, 1 ♀; Mozambique (*F. Muir*), 1 ♂; Ashanti, Gold Coast 2. ii. 1913 (*J. J. Simpson*), 1 ♀.

4. **Tylotropidius gaugeri** Schulth.

1899. *T[ylotropidius] gaugeri*, Schulthess, Bull. Soc. Vaud., xxxv, pp. 209–212, no. 1, figs. 3, 3*a*.

British Museum specimens : Prong, N. Territories, Gold Coast, 4 ii. 1913 (*J. J. Simpson*), 1 ♂, 1 ♀; Etura, Ashanti, Gold Coast, 2 ii. 1913 (*J. J. Simpson*), 1 ♂.

One specimen from Salisbury, Mashonaland, recorded in 1902 by I. Bolivar as *T. gaugeri*, does not belong, in my opinion, to this species, since it has the lateral keels of the pronotum not straight, as is the case in *T. gaugeri*, but

straight and nearly parallel in metazona, and incurved, strongly convergent anteriorly in prozona; it may be a new species, but I abstain from its description on the ground of a single specimen, while I again express the hope that somebody will undertake the revision of this genus.

Genus Metaxymecus Karsch.

1. **Metaxymecus patagiatus** Karsch.

1893. *Metaxymecus patagiatus* Karsch, Berl. Ent. Ztschr., xxxviii, p. 105, no. 73, fig. 15.

British Museum specimen: Gold Coast, N. Territories, Sarkwala, 4–7 xi. 1915 (*J. J. Simpson*), 1 ♀.

Genus Cataloipidius I. Bol.

1. **Cataloipidius roseus** I. Bol.

1914. *Cataloipidius roseus* I. Bolivar, Trab. Mus. Madrid, ser. Zool., N. 20, p. 37.

British Museum specimens: Salisbury, Mashonaland (*G. A. K. Marshall*), 2 ♀♀.

One of the specimens has elytra longer than hind femora and it is of yellowish-brown colour, while in another specimen the elytra just reach the knees and the general colour, especially of lateral stripes on the pronotum, is green.

There is in the Museum collection a female specimen from Abyssinia, apparently belonging to a new species of the same genus, but I do not venture to describe it, since it is badly preserved.

Genus Cataloipus I. Bol.

1. **Cataloipus cognatus** (Walk.).

1870. *Heteracris cognata* Walker, Cat. Derm. Salt. B.M., iv, pp. 656, 658, no. 6.
1870. *Heteracris elegans* Walker, l.c., pp. 662, 663, no. 18.
1902. *Heteracris cognata* Kirby, Trans. Ent. Soc. London, p. 113, no. 122.
1910. *H[eteracris] cognata* Kirby, Syn. Cat. Orth., iii, p. 554, no. 2.
1910. *H[eteracris] elegans* Kirby, l.c., p. 555, no. 12.
1914. *Heteracris elegans* Kirby, Fauna Brit. India, Acrid., p. 267, no. 325, fig. 139.

In his description of *H. elegans* Walker records this species as an Indian one, and so does Kirby in Fauna of British India, but the only specimen in Museum collection (type) is without locality label on it. Since this type of *C. elegans* agrees in all details with the types of *cognata*, I believe that the *elegans* type is also from Africa and that this name is a mere synonym of *C. cognata*, which is a true *Cataloipus*.

Walker's and Kirby's quoted descriptions being based practically on colour characters only, I think it useful to give some of the more important morphological characters of this species.

In its habitus *C. cognatus* is near to *C. oberthüri* Bol., but the elytra are shorter and in the females scarcely reach the apex of the abdomen, while in the males the elytra reach the apex of the abdomen, but fail by a good deal to reach the hind knees. The most striking feature of *C. cognatus*, which distinguishes it from all other known species, is the form of the prosternal tubercle which in the male is strongly narrowed towards the acute apex, bent backwards, with fore side gibbose and hind slightly concave; in females the apex of the tubercle is not acute, but the tubercle is still narrowed towards the apex. Mesosternal lobes with interspace in females quadrate, in males a little longer than wide. Cerci of males have their widest point shortly before apex, being here one and a half times as large as at their base, while in *C. oberthüri* the cerci are only slightly widened before the apex and at their widest point but little broader than at their base. As regards coloration, the difference between *C. cognatus* and *C. oberthüri* is to be seen on the hind femora only, which have in *C. oberthüri* two (rarely confluent) rather wide black spots along the upper margin of area externomedia, while in *C. cognatus* only a narrow grey (very rarely black) stripe is present at this point. Three males from Fort Johnston differ in their coloration from all other specimens, being unicolorous brownish-yellow with obsolete spots on elytra.

The average dimensions of *C. cognatus* are as follows :—

	♂	♀
Length of body . .	33–35 mm.	46–50 mm.
„ „ pronotum .	5, 5–6	7, 5–8
„ „ elytra . .	24–25	31–35
„ „ hind femora .	22–23	28–32

In its geographical distribution *C. cognatus* seems to be restricted to South and S.E. Africa.

British Museum specimens: Pt. Natal, 1 ♀; Natal (*J. F. Quekett*), 1 ♀; Africa, 1 ♀ (*all three Walker's types of Heteracris cognata*); 1 ♀ without locality (*Walker's type of H. elegans*); Pretoria (*W. L. Distant*), 1 ♂; Fort Johnston, Nyasaland, 3 ♂♂ (*P. Rendall*); Salisbury, Mashonaland, 3 ♀♀ (*G. A. K. Marshall*); Orange River Colony, Viedefort Rd. (*G. B. Hamilton*), 4 ♀♀.

2. Cataloipus oberthüri (I. Bol.).

1891. *Euprepocnemis* (*Cataloipus*) *oberthüri* I Bolivar, Ann. Soc. Esp. Hist. Nat., xix, p. 321, pl. 1, figs. 9, 9*a*.
1910. *C*[*ataloipus*] *oberthüri* Kirby, Syn. Cat. Orth., iii, p. 556, no. 1.
1914. *Cataloipus oberthüri* Rehn, Wiss. Ergebn. Deut. Z. Africa Exped., v (1), p. 151.

British Museum specimens: Uganda: Entebbe, Mabira Forest, Kivuvu, Mvale, Kampala, Bonda, Chagwe, Mwera, Mawokota, Bweya (*C. C. Gowdey*), 73 ♂♂, 92 ♀♀.

3. Cataloipus cymbiferus (Krauss).

1877. *Euprepocnemis cymbifera* Krauss, Sitzungsber. Akad. Wiss. Wien, lxxvi (1), p. 40, no. 1, pl. 1, figs. 5, 5A.
1910. *C*[*ataloipus*] *cymbiferus*, Kirby, Syn. Cat. Orth., iii, p. 557, no. 3.

British Museum specimen: Gold Coast, Yapi (*J. J. Simpson*), 1 ♀.

4. Cataloipus somalicus (Rehn).

1901. *Eyprepocnemis somalicus* Rehn, Proc. Acad. Nat. Sc. Philadelphia, liii, p. 377.
‖1903. *Cataloipus oberthüri* Burr, Nat. Hist. Socotra, p. 420, no. 24, pl. 25, figs. 2, 2*a*.
1910. *C*[*ataloipus*] *brunneri* Kirby, Syn. Cat. Orth., iii, p. 557, no. 2.
1914. *Eyprepocnemis somalicus*, Rehn, Wiss. Ergebn. Deut. Z. Africa Exped. v (1), p. 151.
1914. [*Cataloipus*] *brunneri* Rehn, l.c., p. 151.

I cannot find any difference between the descriptions of *C. somalicus* and the type specimen of *C. brunneri;* it is true that Burr's drawing of *C. brunneri* differs somewhat

from the description of *C. somalicus*, but this drawing is still more unlike the specimen from which it was made. In general habitus *C. somalicus* is very like *C. oberthüri* Bol., but it differs markedly in the shape of the male subgenital plate, which in *C. somalicus* is not bent upwards, as in all other species, but horizontal, as may be clearly seen in Burr's drawing. The prosternal tubercle in *C. somalicus* is strongly compressed from in front and behind, in front view quadrate with very slightly emarginated apex, in profile narrow, a little swollen in the middle with slightly narrowed apex; it is rather like the shape of tubercle in *C. oberthüri*, but in the latter species the tubercle appears in frontal view with strongly rounded apical edges and by no means quadrate.

British Museum specimens: Sokotra, 1 ♂ (*Burr's type*); Sokotra, 1 ♀, 1 larva ♀.

5. **Cataloipus abyssinicus**, sp. n.

Size a little larger than in *C. oberthüri* Bol., but smaller than in *C. cymbiferus* Krauss. General colour greenish-yellow, head and pronotum with the usual brown longitudinal stripe in this genus. Frontal ridge gradually narrowed towards the fastigium, with middle and two lateral longitudinal stripes of bluish-grey colour. Pronotum with straight, diverging backwards lateral carinae, disappearing in metazona; lateral lobes bluish-grey, with four subquadrate yellowish spots in the middle and with the fore upper edge blackish, this coloration prolonged narrowly along the lateral carinae (up to third transverse sulcus) and along the fore margin. Prosternal tubercle nearly cylindrical, very slightly impressed behind, not narrowed towards the apex, obtuse, directed slightly backwards. Space between the mesosternal lobes nearly twice as long as broad. Elytra yellowish with brown veins, with greenish stripes in scapular and axillar fields, without any spots or points; they reach the apex of abdomen, but not hind knees. Hind femora with very slightly darkened upper keel of area externomedia; knees blackish with pale lobes. Hind tibiae greyish-blue with pale ring near the basis. Supra-anal plate bluish, with short attenuate apex and short sulcus at the base. Cerci compressed, especially in the apical third, where they are far broader than at their base and strongly bent downwards. Subgenital plate large, erected with a short angular emargination at the apex.

Dimensions of the typical male are: Length of the body 38 mm.; of pronotum 6·5 mm.; of elytra 27 mm.; of hind femora 27 mm.

Two female cotypes, rather badly preserved, still showing strong likeness to the male in their coloration; prosternal tubercle in females is slightly narrowed towards the apex; space between mesosternal lobes a little longer than broad, widened backwards; elytra with slight traces of dark spots. Dimensions of one of these females are: Length of the body 61 mm.; of pronotum 10·5 mm.; of elytra 45 mm.; of hind femora 37·5 mm.

This species is easily recognised by its coloration and the form of prosternal tubercle and mesosternal interspace.

British Museum specimens: Atbara, Abyssinia, 1 ♂ (*type*), 2 ♀♀ (*cotypes*).

6. **Cataloipus roseipennis,** sp. n.

Smaller than any known species and distinct in its coloration, the general colour being brownish, with a darker longitudinal stripe along the head and pronotum, prolonged a little at the base of elytra. Face yellow, with infumate frontal ridge; the latter nearly parallel, rather suddenly narrowed near the fastigium. Fastigium wide and short, with lateral impressions small, but well expressed, while two opaque hind impressions are nearly obliterate. Pronotum with lateral carinae straight, slightly divergent backwards, disappearing in metazona; lateral lobes brownish with lighter coloured middle and blackened fore upper edge. Prosternal tubercle compressed, slightly concave behind and gibbose at the fore side, seen from front with circular rounded apex. Mesosternal lobes transverse with quadrate interspace. Elytra dark brown with sharp sulphurous stripe in scapular field and obliterate greenish in axillar field. Wings rose, with brown veins, slightly infumate towards the apex. Anal segment with two widely separated obtuse teeth. Supra-anal plate with sides rounded (its apex is broken in the type). Subgenital plate large, erected, with deep, rotundate emargination at the apex and apical lobes truncate with oblong impression at the lower side, just below apical emargination. Cerci compressed, with apical third dilated and bent downwards. Hind femur pale, with rather wide blackish stripe along the upper keel of externo-median area and brown lower keel; the inner side is bluish with dark brown stripe along the upper margin; knees unicolorous from above, with black side ring and pale lobes. Hind tibiae dull blue with a lighter ring near the base.

Dimensions of the type male are: Length of body 29 mm.; of pronotum 5·5 mm.; of elytra 23 mm.; of hind femora 19 mm.

The coloration alone is quite enough to distinguish this species from all others, but it has some very good morphological characters, too, as is evident from the above description.

British Museum specimens : Fort Johnston, Nyasaland (*P. Rendall*), 1 ♂ (*type*) (named by W. F. Kirby as *Demodocus cognatus* Walk.); Chirinda Forest, Gaza Land, 28 i. 1904 (*G. A. K. Marshall*), 1 ♀ (*cotype*).

Genus Amphiprosopia, n. g.

Fastigium of the vertex prominent before the eyes, with two oblong lateral impressions and two opaque spaces, divided by a carina, between the eyes (as in genus *Cataloipus*). Frontal ridge slightly convex, gradually widening downwards. Lateral ocelli placed close to the eyes, at some distance from lateral margin of fastigium of the vertex. Antennae filiform, in male a little longer than head and pronotum, in female scarcely reaching hind margin of pronotum. Pronotum with straight lateral carinae, divergent backwards; median carina more markedly interrupted by hind sulcus only; metazona twice as short as prozona; hind margin of pronotum very slightly rotundate. Prosternal tubercle cylindrical, obtuse, bent backwards. Mesosternal lobes in both sexes transverse; interspace twice as long as broad. Metasternal lobes in ♂ contiguous, in ♀ narrowly separated. Elytra in ♂ as long as the abdomen, in ♀ far shorter. Wings shorter than elytra, narrow. Hind femora narrow, elongate. Hind tibiae with 9 spines inwardly and 11 outwardly. Hind tarsi elongate, with second joint twice as long as it is broad. Abdomen of the male with anal segment inflated; supra-anal plate subquadrate, large; cerci compressed, very wide, with short teeth near the apex; subgenital plate short and broad, with two very long narrow lateral lobes.

Type of the genus : *Heteracris adjuncta* Walker.

Walker's *Heteracris adjuncta*, redescribed later on by Karsch under the name *Demodocus amphiprosopus*, certainly does not belong to the genus *Choroedocus* Bol., since it has the second joint of hind tarsi elongate and the lateral ocelli placed at some distance from the margins of the fastigium. Besides, the vertex has on it impressions quite like those in *Cataloipus*, which is not the case in *Choroedocus*.

1. **Amphiprosopia adjuncta** (Walk.).

1870. *Heteracris adjuncta* Walker, Cat. Derm. Salt. B.M., iv, pp. 656, 657, no. 5.

1870. [*Heteracris adjuncta*] var.? Walker, l.c., p. 657.
1893. *Demodocus amphiprosopus* Karsch, Berl. Ent. Ztschr., xxxviii, pp. 106, 107, no. 74, fig. 16.
1910. *H*[*eteracris*] *adjuncta* Kirby, Syn. Cat. Orth., iii, p. 555, no. 5.
1910. *H*[*eteracris*] *amphiprosopus* Kirby, l.c., p. 555, no. 6.

There is not the slightest doubt that Karsch has described and figured under the name *Demodocus amphiprosopus* Walker's *Heteracris adjuncta*, of which I have the types before me. Walker's specimens are in bad condition, but their coloration and other characters perfectly agree with Karsch's description.

British Museum specimens: Sierra Leone, 2 ♀♀; 1 ♂ without locality label (*Walker's types*); Gold Coast, Sarkwalla, N. Territories, 4–7 xi. 1915 (*J. J. Simpson*), 1 ♀.

III. *Notes on Synonymy and on some Types of Oriental* Carabidae *in various foreign collections.* By H. E. Andrewes.

[Read February 2nd, 1921.]

I.

In May 1920, thanks to the kindness of M. René Oberthür, I had the opportunity of examining a considerable number of the types of Carabidae in his collection; this includes, beside other material, the collections formed by Dejean, Chaudoir, and H. W. Bates, the principal authors in the group. I have to thank M. Oberthür—and I do so very cordially—not only for allowing me to examine his collections, but also for the personal assistance he was kind enough to give me during my visit to him at Rennes. Some of the results of my examination are embodied in the following notes on synonymy, etc., and, as a further result, I am describing a few new species from among those which I found to have been misidentified.

As I shall have to refer rather frequently to my paper published in these Transactions in 1919, I shall, to save space, merely give the date and the page.

Calosoma scabripenne Chaud. (Ann. Soc. Ent. Fr. 1869, 371) = *C. indicum* Hope (1919, 171).

When my former paper appeared, I was unaware of Dr. Roeschke's remarks on the genus *Calosoma* in Entomologische Nachrichten 1900. I see that he there treats *C. scabripenne* Chaud., as a variety of *indicum*, and both of these as races of *C. maderae* F.

I also expressed the opinion (p. 202) that *C. orientale* Hope = *C. squamigerum* Chaud. Dr. Roeschke is of opinion that Hope's species is identical with *C. imbricatum* Klug. I have in my collection some examples of this species from the Cape Verde Is., and there are others in the British Museum from the Persian Gulf, together with a solitary very dull specimen from Karachi. It is not unusual to find N.E. African species reappearing in Sind: *Calosoma olivieri* Dej. occurs not only in Baluchistan, but as far up the Indus Valley as Peshawar. The species of Carabidae inhabiting the sandy tract stretching from Egypt to Sind are, however, quite unlikely to extend their habitat so far south, or so high up as Poona, and I cannot

recall any which do so. The size of Hope's specimen (10½ lines) does not help us much, for it is about midway between average examples of the two species. Hope's remark about the curvature of the intermediate tibiae seems to me to apply better to *squamigerum* (of which I have before me an example compared with the type) than to *imbricatum*, and I still think the view I took is probably correct.

Distichus planus Bon. (Obs. Ent. ii, 1813, 470). In his Monographie des Scaritides (Ann. Soc. Ent. Belg. 1880, 53) Chaudoir says that he has an example of this species taken by Capt. Boys in North India. I cannot distinguish any differences between this example, which I examined, and Chaudoir's *D. punticollis* (Mon. 55), and think that Bonelli's species should for the present be ruled out of the fauna of India, though it occurs in Baluchistan.

Tachys politus Motch. (1919, 199). M. Severin, of the Brussels Museum, has been good enough to send me for examination the type of *T. bioculatus* Putz., and in M. Oberthür's collection I have seen an example of *T. ebeninus* Nietn., labelled in Nietner's handwriting. I cannot detect any material difference in these specimens, and I refer both of them to Motchulsky's *T. politus*.

Tachys mirabilis Bates (Ann. Mus. Civ. Gen. 1892, 294) = *T. ovatus* Motch. (Bull. Mosc. 1851, iv, 509) (1919, 198).

Siagona atrata Bates (not Dej.) (Ann. Mus. Civ. Gen. 1892, 284). Bates misidentified this species when determining the Carabidae taken by Mr. Fea in Burma, and, as the Burmese species is a new one, I give a description of it at the end of this paper. The example from Senegal, mentioned by Dejean (Spec. Gen. v, 1831, 476) must be something different, but unfortunately I have not seen it.

Siagona subtilis Bates (Ann. Mus. Civ. Gen. 1892, 284) = *S. obscuripes* Chaud. (Mon. 86).

Siagona cinctella Bates (not Chaud.) (Ann. Mus. Civ. Gen. 1892, 285). Here Bates misidentified another of Mr. Fea's Burmese species, a description of which will be found at the end.

Callistomimus coarctatus Laf.* (Ann. Soc. Ent. Fr. 1851, 230). Chaudoir, when describing the genus *Callistomimus* (Bull. Mosc. 1872, ii, 382), identified this species with

* Since the above was written, a note of mine on all the Oriental species of *Callistomimus* has appeared (P.Z.S., June 1921), in which both *coarctatus* and *littoralis* are referred to, and also figured in the plate.

C. littoralis Motch. (Et. Ent. 1859, 33) and *C. westwoodi* Schaum (Berl. Ent. Zeit. 1863, 85); in this he was followed by Bates (Comp. rend. Soc. Ent. Belg. 1891, 327). I find that *C. coarctatus* is a larger species than *C. littoralis* and that it differs considerably in other respects, as is quite clear from the description. *C. westwoodi* appears to be identical with *C. littoralis*.

Chlaenius javanus Chaud. As I anticipated in my former paper (1919, 137), this species is indistinguishable from *C. circumdatus* Brullé.

Chlaenius submarginatus Bates (not Chaud.) (Comp. rend. Soc. Ent. Belg. 1891, 328). The specimens taken by Père Cardon at Tetara and determined by Bates as belonging to this species are actually examples of *C. fugax* Chaud. (Mon. 266).

Chlaenius frater Bates (not Chaud.) (Ann. Mag. Nat. Hist. (5), xvii, 1886, 74) is a misidentification. I have therefore described the species further on.

Diplochila distinguenda Laf. I recently identified this species (1919, 193) with *D. retinens* Walk. and *D. rectificata* Bates. I find, to my surprise, that the type specimen is identical with *Eccoptogenius moestus* Chaud. (Bull. Mosc. 1852, i, 74), which must therefore take Laferté's name. The species of *Diplochila* would take the name of *D. retinens* Walk., which is anterior to Bates' *D. rectificata*, were it not that—as will be seen later—a yet older one exists in *D. polita* F. Bates did not apparently know the genus *Eccoptogenius*, the specimens referred by him to that genus (Ann. Soc. Ent. Fr. 1889, 267)—for a knowledge of which I am indebted to M. E. Fleutiaux—belonging to the genus *Diplochila*.

Gnathaphanus acutipennis Bates * (Ann. Mus. Civ. Gen. 1892, 328) = *G.* (*Selenophorus*) *orientalis* Dej. (Spec. Gen. iv, 1829, 128).

Dicryche (Platymetopus) amoena Dej. (1919, 155). Having now examined the type of Dejean's species, I find that, though very closely related to *D. torta* Macl., it is not identical with it. Bates' determinations of the species are, I think, correct. Mr. T. G. Sloane has sent me a Javan specimen, exactly agreeing with Macleay's type, and I have seen another example in the collection of the Brussels Museum.

Gnathaphanus (?Platymetopus) gnathaphanoides Bates (Ann.

* Since the above was written, I have published a note on the Oriental species of this genus (Ann. Soc. Ent. Belg., 1920, pp. 106–11).

Mus. Civ. Gen. 1892, 332 (note); Andr., Ann. Mag. Nat. Hist. (9), iii, 1919, 473). I think that Bates has quite deceived himself in regard to this species. In his description he says "♂ tarsi 4 antici anguste dilatati, plantis lateribus longe pilosis, medio transverse squamulatis." Unless I also am the subject of an optical illusion, all the specimens which were in his collection are female examples of *Gnathaphanus punctilabris* Macl.

Abacetus atratus Bates (not Dej.) (Ann. Mag. Nat. Hist. (5), xvii, 1886, 143) = *A. cordicollis* Chaud. (Mon. 357). Bates was singularly unsuccessful with the six species of *Abacetus* taken by Mr. George Lewis in Ceylon. Of the four identified with pre-existing species three were wrong, and of the two described one had already been described three times before.

Abacetus aeneus Nietn. (Ann. Mag. Nat. Hist. (3), ii, 1858, 177). This species proves to be identical with *A. placidulus* Walk. = *A. infixus* Walk. = *A. carinifrons* Bates (1919, 189). The name of *aeneus* being preoccupied in the genus, Chaudoir changed it to *nietneri*, but the species must retain the older name of *A. placidulus* Walk. *A. nietneri* Bates (not Chaud.) (Ann. Mag. Nat. Hist. (5), xvii, 1886, 145) and *A. maculipes* Bates (not Chaud) (Ann. Mus. Civ. Gen. 1892, 361) are species which I am not at present in a position to determine.

Abacetus antiquus Bates (not Dej.) (Ann. Mag. Nat. Hist. (5), xvii, 1886, 144) = *A. dejeani* Nietn. (Ann. Mag. Nat. Hist. (3), ii, 1858, 178). It follows from this, *A. relinquens* Walk. = *A. dejeani* Nietn. (1919, 189), but Nietner's description appeared a few pages before Walker's in the same journal.

Abacetus hirmocoelus Chaud. (Mon. 372). This name has been quoted by Bates, but it is clearly a typographical error for *hirmocoelus*. It is so printed in the index to the Monograph, and also appears in this form on a written label in the Chaudoir collection.

Pristonychus kashmirensis Bates (Proc. Zool. Soc. 1889, 214; Andr., Ann. Mag. Nat. Hist. (9), iii, 1919, 475). I identified this species with *P. spinifer* Schauf. (Sitz. Ges. Isis. 1862, 66), but having now compared the two types I have convinced myself that the species are different, and I desire therefore to withdraw this synonymy.

Colpodes ischioxanthus Bates (Ann. Mus. Civ. Gen. 1892, 376) = *C. cruralis* Chaud. (Révision des Colpodides 376).

Pogonoglossus validicornis Bates (not Chaud.) (Ann. Mus

Civ. Gen. 1892, 388) proves to be another misidentification, and I therefore give a description of Bates' species at the end.

Pheropsophus marginalis Dej. (Spec. Gen. i, 1825, 310). This species was said to come from the "Indes Orientales," and a second specimen beside it in M. Oberthür's collection, which I look upon as identical, bears the label "Pondichery." It is difficult to understand how Chaudoir, with Dejean's type before him, came to identify with it a larger and very variable species from Indo-China, which he describes in his Monograph (p. 34), but which to my eyes is altogether different. I think that *P. curtus* Arrow (Trans. Ent. Soc. Lond. 1901, 204, t. 9, f. 3) is identical with *marginalis* Dej., but the examples of this species from Malabar have a black prothorax, and no yellow margin to the elytra. Cotypes of this species from Kanara, however, in my collection have a yellow stripe on each side of the prothorax, and the elytra have a yellow border from the fascia to the apex. I think Chaudoir's species should bear the name of *P. nebulosus* Chaud. (Mon. 27), proposed by its author for what he considered a variety of his (not Dejean's) *P. marginalis*.

Brachynus timoriensis Jord. (Nov. Zool. i, 1894, 105) belongs to the genus *Styphlomerus*. It hardly differs from *S. bicolor* Boh. (Eugenies Resa Ins. iv, Col. 1861, 3), but the head is rather wider and also darker in colour.

Orthogonius parallelus Bates (not Chaud.) (Ann. Mag. Nat. Hist. (5), xvii, 1886, 201) = *O. acutangulus* Chaud. (Bull. Mosc, 1878, iii, 5).

Orthogonius collaris Dohrn (Stett. Ent. Zeit. 1891, 253) = *O. doriae* Putz. (Chaudoir's Mon. 104 [note]). I have seen Putzey's type, but identify Dohrn's species from his description.

Catascopus costulatus Chaud. (Rev. et Mag. Zool. 1862, 489). Quite recently (1919, 182) I identified this species with *C. presidens* Thoms., and *C. splendidus* Saund. I have now seen all the types and also that of *C. aeneus* Saund. (Trans. Ent. Soc. Lond. 1863, 467, t. 17, f. 2). I find that *C. presidens* = *C. splendidus*, and that *C. costulatus* = *C. aeneus*; *C. presidens*, in addition to its purple patches, has the elytral carinae more strongly developed than *C. costulatus*, but the species are exceedingly closely allied.

Catascopus reductus Chaud. (not Walk.) (Berl. Ent. Zeit. 1861, 117) = *C. cingalensis* Bates (Ann. Mag. Nat. Hist.

(5), xvii, 1886, 203) = *C. severini* Bates (Comp. rend. Soc. Ent. Belg. 1891, 339).*

Tetragonoderus cardoni Bates (Comp. rend. Soc. Ent. Belg. 1891, 338; id. Ann. Mus. Civ. Gen. 1892, 416) = *T. arcuatus* Dej. (Spec. Gen. iv, 1829, 495). I have examined a large number of specimens from N. India, and find that the sericeous patches on the elytra are very variable, being sometimes conspicuous and sometimes altogether wanting: as a rule they are present but not very noticeable. I do not regard Bates' species as differing from Dejean's.

Lioptera pseuda Heller (Ann. Soc. Ent. Belg. 1903, 241). Dr. Heller did not know the locality of this species, which has recently been taken by Mr. R. Vitalis de Salvaza in Laos.

Sarothrocrepis bimaculatus Jord. (Nov. Zool. i, 1894, 106) belongs to the genus *Lebidia*.

Callida excelsa Bates (Ann. Mus. Civ. Gen. 1892, 422) = *C. lativittis* Chaud. (Mon. Callidides, 113).

Physodera davidis Fairm. (Ann. Soc. Ent. Belg. 1887, 92) = *P. eschscholtzi* Parry (Trans. Ent. Soc. Lond. 1849, 179, t. 18, f. 2).

II.

A visit to Copenhagen in September 1920 has enabled me to identify a considerable number of doubtful species, but has also revealed the fact that many of the types of Oriental Carabidae to be found in the University Museum of that city have been misidentified or are quite unknown. Hope seems to have been the first (Col. Man. ii, 1838, pp. 37–45) to publish his views on the Fabrician types and the genera to which the various species should be attributed. The collections at Copenhagen were visited by Erichson, Schaum, and Motchulsky, each of whom has added a little to our knowledge of them. Erichson does not seem to have published his notes, but Schaum (Stett. Ent. Zeit. 1847, pp. 39–57) and Motchulsky (Et. Ent. 1855, pp. 25–71) both wrote memoirs on the Fabrician insects. So far as I can ascertain neither Baron de Chaudoir nor H. W. Bates went to Copenhagen, and it seems to be due chiefly to the writings of the former that a tradition has grown up regarding certain species, which proves upon investigation to be ill-founded. I took with me to Copenhagen a good many

* I have referred to this quite recently in describing some new species of *Catascopus* (Ann. Soc. Ent. Belg., 1921, 202).

specimens for comparison, but in some cases I had no knowledge whatever of the species described or even the genus to which it belonged. Since my return I have sent specimens of most of these species to Mr. Henriksen, who has very kindly made the comparisons which I was unable to make personally.

The types with which I propose to deal in this section are those of Fabricius and Wiedemann, which I will take separately, giving references where necessary and indicating both the modern and original genera. Unless otherwise specified, the type, where seen, agrees with the traditional identification. I may add that I found the collections in the most excellent condition.

The Fabrician types at Copenhagen came chiefly from the Schestedt and Tonder Lund collections, the incorporation of which in the general collection was undertaken by Schiödte (1815-1884): this came to a stop at his death, and has not been completed. The Wiedemann types were in the collection of B. W. Westermann (1781–1868), a merchant of Copenhagen, who in early life held appointments in Calcutta and Batavia. He returned to Denmark in 1817, and with the aid of his oversea connections formed a very large collection of insects, which at his death came to the Zoological Museum. By the terms of his will the collection was to remain intact until the beginning of the new century, and its subsequent incorporation, commenced in 1900, is still uncompleted.

I have to thank Dr. Will. Lundbeck for the kind reception which he gave me at the University Museum, and my special thanks are due to Mr. Kai L. Henriksen, who devoted himself to finding and showing me the various types which I desired to see, and also furnished me with the information I have given about the Copenhagen collections, and the various entomologists connected with them.

The private collection of Fabricius, which contains a certain number of types, is now in the Zoological Institute and Museum of Kiel University. I have not seen this collection, but, at my request, the Director of the Department, Dr. Reibisch, has examined it to ascertain whether it contains the types of certain species of which I sent him a list. I have to thank him for doing this and for enabling me to indicate the types that are at Kiel. He informs me that the arrangement of the collection follows that given in the *Systema Eleutheratorum:* the labels are in the hand-

writing of Fabricius, and, although the specimens in question are not of course so marked, there is no reason to doubt that these are in fact the types of the species which he described. It will be noted that very few types are actually lost, and possibly some of these may ultimately be found in other collections.

I have also to thank Mr. P. Lesne for looking up the types in the "Bosc" collection at the Paris Museum, which I hope before very long to see for myself.

Fabricius.

In my former paper (1919, 120) I gave some notes about Fabricius and the types of the half-dozen species of Oriental Carabidae in the British Museum described by him. There are many more species at Copenhagen, and I propose here to give a complete chronological list of all the species which he described, accompanied by such information as I am able to give about them. At the end of his descriptions Fabricius usually gives the name of the collector of the specimens or of the collection in which they are to be found, sometimes both. The names of Banks, Sehestedt, Lund, Vahl, and Bosc indicate collections, of which the first is in the British Museum, the next three in the Copenhagen Museum, and the last in the Paris Museum. The names of Daldorff, Smidt, and Schousboe indicate collectors only, some of whom gave the insects collected to Fabricius himself, while others gave them to the Copenhagen Museum. Dr. König was a physician, who was educated in Copenhagen and subsequently resided in India. His collections found their way to the Amphiteatrum oeconomico-naturale in the Castle of Charlottenborg, and were united with those of the University about 1770, but the insects seem to have perished and no types are to be found. The Hybner collection was acquired by Germar, whose collection, as I learn from Dr. Walther Horn, is now at Halle. Generally speaking, where no name is given, it appears probable that the type is in the Fabrician collection in the Kiel University Museum.

It will be noted that I have included a few palaearctic species in my list, but this is because they are found as far East as Japan. In the case of each species I give the earliest reference, but many of the descriptions were repeated by Fabricius in works subsequent to that in which they first appeared.

(1) Systema Entomologica (1775).

1. **Anthia (Carabus) sexguttata,** p. 236. (Banks.) Type in British Museum (1919, 121 and 200).

2. **Calosoma (Carabus) maderae,** p. 237. (Banks.) Type in British Museum (1919, 171).

I have included this species in my list because, under one or other of its diverse forms, it is widely spread over the palaearctic, and even reaches the subtropical regions of the Old World.

3. **Pseudophonus (Carabus) ruficornis,** p. 241. Type in Kiel University Museum.

First described by de Geer (Mém. Ins. iv, 95, 1774). Another well-known palaearctic species, which ranges from Western Europe to Eastern Asia.

4. **Pheropsophus (Carabus) bimaculatus,** p. 243. Type in Kiel University Museum (1919, 120).

First described by Linnaeus (Mant. Ins. 1771, 532). In my former paper I included this species by inadvertence amongst those of which the type is in the British Museum, although in the text I indicate correctly that it is actually in the Museum of the Linnaean Society.

5. **Plocionus (Carabus) pallens,** p. 244. This type cannot at present be traced.

This species, which is cosmopolitan, was redescribed by Dejean (Spec. Gen. i, 1825, 251) as *P. bonfilsi;* it is also mentioned and figured both by Brullé (Hist. Nat. des Ins. iv, 1834, 224, t. 7, f. 6) and Hope (Col. Man. ii, 1838, t. 1, f. 6). Gory also described it (Ann. Soc. Ent. Fr. 1833, 189) as *P. boisduvali.* See also Chaudoir (Mon. des Callidides, Ann. Soc. Ent. Belg. xv, 1872, 168), Fauvel (Revue d'Ent. 1889, 100), and Bedel (Faune Seine, i, 1879, 114).

The type came from Dresden, Dejean's specimen from Bordeaux, and Gory's from Senegal. Chaudoir gives as localities the South of France, Senegal, Mauritius, Java, Polynesia, California, Mexico, Amazon, and Cartagena (New Granada): to these I may add China. I have several records from Java, the insects in one instance having been taken "in stored rice" (*Dr. Roepke*).

6. **Cyclosomus (Scolytus) flexuosus,** p. 246. (König.) There is a specimen at Kiel, which is the equivalent of the type.

As already mentioned, the types in the König collection have perished, but the specimens in the Copenhagen Museum quite accord with the description, and I have no doubt that

the traditional identification is correct. The species was redescribed by Nietner (Journ. As. Soc. Beng. 1857, ii, 132; id. Ann. Mag. Nat. Hist. (2), xx, 1857, 272) under the name of *C. dyti(s)coides*: Chaudoir considered this a distinct species (Etude monographique des Tetragonodérides, etc., Bull. Mosc. 1876, iii, 31). Other references are numerous. I have various records from India and Ceylon, and the species apparently occurs also in Indo-China, and at Hong-Kong, though I feel some doubt about the identity of the specimens from this last locality.

(2) Species Insectorum, i (1781).

7. **Craspedophorus (Carabus) angulatus,** p. 302. (Banks.) Type in British Museum (1919, 125).

8. **Luperca (Carabus) laevigata,** p. 304. (Banks.) Type in British Museum (1919, 122).

9. **Chlaenius (Carabus) cinctus,** p. 310. (Banks.) Type in British Museum (1919, 122).

10. **Craspedophorus (Pimelia) fasciatus,** p. 318. (Lund.) Type at Copenhagen (1919, 125).

I find that Schaum was quite right in identifying this species with No. 7 *C. angulatus* F.

(3) Mantissa Insectorum, i (1787).

11. **Calosoma (Carabus) indagator,** p. 127. (Vahl.) Type at Copenhagen.

I have not of course been able to compare this type with that of *C. maderae* F. (see above No. 2), which is in the British Museum, but I have no doubt that they belong to the same species.

12. **Dolichus (Carabus) flavicornis,** p. 199. (Hybner.) Type probably at Halle, but there are two specimens at Kiel.

A well-known European species, which I have included, because its habitat extends from Europe to China and Japan.

The species was first described by Schaller (Naturf. Ges. Halle, i, 1783, 317) under the name of *Carabus halensis*.

13. **Pterostichus (Carabus) oblongopunctatus,** p. 202. (Lund.) The type is lost.

Another palaearctic species ranging from Europe to Japan.

14. **Acupalpus (Carabus) dorsalis,** p. 205. (Daldorff.) Type in Kiel University Museum.

Like the two last this is a widely distributed palaearctic species. See Bedel (Cat. rais. des Col. du N. de l'Afrique,

1899, 158, note (2)) and Andrewes (Ann. Mag. Nat. Hist. (9), iii, 1919, 475).

(4) Entomologia Systematica, i (1792).

15. **Scapterus (Scarites) crenatus,** p. 95. (Lund.) Type at Copenhagen.

No one, so far as I know, has commented on this species since it was first described. I had no suspicion that the genus would prove to be *Scapterus*, and did not therefore take any specimens for comparison. I have, however, since sent to Copenhagen a specimen of the genus, which I identify with *S. sulcatus* Putz., but Mr. Henriksen informs me that, as I expected, it does not quite agree with the Fabrician type. This latter is 13 mm. in length; the tubercle on the head is short and distinct, the vertex being smooth behind it, the sides moderately and rather vaguely striate; the prothorax is quite smooth, with parallel sides, the front angles porrect and a faint round fovea on each side at base; the elytra are short, nearly parallel, hardly sulcate, but with strongly punctured striae. The species is evidently near *S. gucrini* Dej. (Spec. Gen. ii, 1826, 472), of which I have seen the type, but differs in several particulars. I do not know *S. riparius* Gestro, or *S. figuloides* Gestro (Ann. Mus. Civ. Gen. 1882, 299 and 301), but from the descriptions I do not think either of them conforms to Fabricius' species. It is to be hoped that further material will come to hand of this curious and scarce genus.

16. **Nebria (Carabus) lateralis,** p. 134. (Daldorff.) Type in Kiel University Museum.

A race of the common *N. livida* L., which extends as far East as Japan.

17. **Zuphium (Carabus) olens,** p. 139. (Bosc.) The type appears to be lost.

Originally described by Rossi (Faun. Etrusc. i, 1790, 217, t. 5, f. 2) from Italy. The specimen which served Fabricius for his description should be in the Paris Museum, but Mr. Lesne tells me that it cannot be found. The species is widely spread over the Mediterranean basin and in Southern Asia, and references to it are numerous in entomological literature.

18. **Pheropsophus (Brachinus) tripustulatus,** p. 145. (Banks.) Type in the British Museum (1919, 124).

19. **Diplochila (Carabus) polita,** p. 146. (Lund.) Type at Copenhagen (1919, 144).

In my former paper I gave some notes on this species on

the assumption, which turns out to be erroneous, that the traditional identification was accurate. In the genus *Diplochila* there are two very closely allied species, in one of which the labrum is very deeply and the clypeus moderately excised—enough to show the basal membrane of the labrum; in the other the labrum is deeply excised and the front margin of the clypeus nearly straight. When Dejean described his *D. polita*, he did so on specimens sent to him by Westermann and Gyllenhal as the true *Carabus politus* of Fabricius. Actually they belonged to the first of the species mentioned above, which I have verified by an examination of Dejean's type, whereas Fabricius' insect belongs to the second.

Whether Herbst's *Carabus indicus* is identical with the first, or with the second, or with either of them, we shall probably never know, as Gemminger and Harold inform us in the preface to their Catalogue that this author's collection has perished.* In these circumstances I think it best to give Dejean's species a new name, and accordingly I suggest *D. perscissa*. The synonymy will then be (1) *D. polita* F. = *retinens* Walk. = *rectificata* Bates, (2) *D. polita* Dej. = *perscissa* nom. nov. I have already given a number of references (1919, 144 and 192), and among them one to *Rhembus distinguendus* Laf., which must now be withdrawn. (See note in Section I.)

20. **Calosoma (Carabus) sericeum**, p. 147. (Smidt.) Type in Kiel University Museum.

This species appears to be identical with the widely spread *C. auropunctatum* Herbst (Fuessly's Archiv, 1784, 131). Bates (Entom. 1891, Suppl. 8) considered that specimens taken by Capt. Graham Young in Kulu, N.W. India, belonged to it.

21. **Chlaenius (Carabus) micans**, p. 151. (Bosc.) Type in Paris Museum (1919, 139).

A specimen in the Copenhagen collection, coming from Paykull, and bearing the name of *C. micans* F., is identical with *C. pictus* Chaud. I think it must be wrongly named, for Mr. Lesne has found at Paris what he considers to be Fabricius' type, and he tells me that the apical spot is not virguliform. I hope later on to examine it and settle the point.

* I now learn from Dr. W. Horn that Herbst's types are in the Zoological Museum of the Berlin University.

22. **Amara (Carabus) ovata,** p. 154. (Smidt.) Type in Kiel University Museum.

Another common palaearctic species, the range of which extends from Europe to Japan.

23. **Somotrichus (Carabus) elevatus,** p. 162. (Bosc.) Type probably in Paris Museum, but there is also a specimen at Kiel (1919, 178).

Mr. Lesne tells me that he believes the type is at Paris, but at the time he could not find it. I dealt fully with this species in my former paper.

24. **Trechus (Carabus) discus,** p. 164. (Smidt.) Type in Kiel University Museum.

Bates records this European species as being found as far East as Japan.

25. **Bembidium (Elaphrus) striatum,** p. 179. (Smidt.) Type in Kiel University Museum.

Also recorded by Bates from Japan.

(5) Supplementum Entomologiae Systematicae (1798).

26. **Oxylobus (Scarites) porcatus,** p. 43. (Schestedt.) Type at Copenhagen.

I do not think any one has yet identified this species, which I find to be the same as Chaudoir's *O. costatus* (Mon. des Scaritides, Ann. Soc. Ent. Belg. 1879, 134). I have numerous records from South India, but the species extends northwards through the Central Provinces and Orissa to Bengal.

27. **Chlaenius (Carabus) spoliatus,** p. 54. (Schousboe.) Type at Copenhagen.

Originally described by Rossi (Faun. Etrusc. Mant. 1792, 79). The species is widely distributed over the Mediterranean basin and Central Asia. I have recently seen specimens taken by the Indian Zoological Survey at Seistan.

28. **Tetragonoderus (Carabus) quadrinotatus,** p. 55. (Daldorff.) Type at Copenhagen.

A well-known Indian species, redescribed by Dejean (Spec. Gen. iv, 1829, 491), and also by Chaudoir in his Étude monographique des Tetragonodérides, etc. (Bull. Mosc. 1876, iii, 41). It occurs all over India and in Ceylon, but apparently not elsewhere.

29. **Siagona (Carabus) depressa,** p. 56. Types at Copenhagen and Kiel.

Some discussion has centred round this species (see Bedel, Ann. Soc. Ent. Fr. 1887, 195; id. Cat. rais. des Col. du Nord de l'Afrique, 1897, 108; Andr., Ann. Mag.

Nat. Hist. (9), iii, 1919, 470), and, as not infrequently happens when the type of a species is a matter of conjecture, there has been a waste of paper and ink.

The species was described from specimens taken by Schousboe in Mauretania and by Daldorff in "India Orientali" (Coll. Schestedt). I found at Copenhagen two "Mauretanian" specimens, one of them indicated (though not by Fabricius) as the type, but there was no Indian specimen. At Kiel, on the other hand, Dr. Reibisch found, under the genus *Galerita*, a single specimen of a *Siagona*, bearing the name *depressa* in Fabricius' handwriting, but without indication either of the locality from which it came, or of the name of the collector. The Copenhagen specimens I recognised as being identical with *S. dejeani* Rambr. (or what passes as that species, for I have not seen the type), an insect nearly twice as long as, and quite different in shape from *S. europea* Dej. Mr. Henriksen has kindly compared with the "type" a specimen which I sent to him, and finds it to agree exactly. Dr. Reibisch kindly sent me the Kiel example to examine, and I find it to be the same species as Chaudoir's *S. germana*: I have in my collection a defective example of this species, which I compared with Chaudoir's type, and, although this does not entirely agree with the Kiel specimen, the resemblance is so close as to leave no doubt in my mind that they belong to the same species. I think Chaudoir's *S. punctatissima* is also identical with them.

It is not clear from the Fabrician description whether or not both the "Mauretanian" and Indian specimens were in Schestedt's collection, but, judging by the above facts, it seems almost certain that the former only belonged to him, the Indian example being in Fabricius' own collection. Two further observations may be made, one that in his descriptions—at least in such as I have studied—Fabricius does not mention his own collection, and the other, that three years later in Syst. Eleuth. (i, 1801, 215) no mention is made under *Galerita depressa* of the "Mauretanian" specimens, and the only reference is "India Orientali, Daldorff."

In these circumstances the small Mediterranean species will retain Dejean's name of *S. europea*, and for the small Indian one, now known as *S. depressa*, I propose the new name of *S. fabricii*. As Rambur's *S. dejeani* (1838) was described long before Chaudoir's *S. germana* (1876), Ram-

bur's name should stand for the African species, and *S. germana* should in future be known as *S. depressa* F., the specimen at Kiel being regarded as its type.

30. **Pheropsophus (Carabus) hilaris,** p. 56. (Lund-Daldorff.) Type at Copenhagen.

The description of this species hardly leaves room for doubt that Fabricius had before him a specimen of the traditional *P. hilaris* (= *P. sobrinus* Dej., with a black band of varying width at the base and apex of the prothorax). Actually the type does not conform with the description, but agrees—as does a second specimen—with *P. tripustulatus* F. (see No. 18). I cannot but think that there has been in the past some transposition of labels: if the type is accepted, the name of *hilaris* will fall into synonymy with *tripustulatus*, but if in the special circumstances the type is ignored and the description accepted, the species now known as *P. hilaris* will retain its name. I propose to accept the description and make no change.

The species (as described) is well known and has been referred to by many authors: Chaudoir deals with it in his Mon. des Brachynides (Ann. Soc. Ent. Belg. 1876, 25). It occurs all over India and in Burma, but I have not seen specimens from Ceylon: there are examples from Baluchistan in the Indian Museum, Calcutta, and in the Chevrolat collection (Oxford University Museum) is one labelled Java—probably in error.

31. **Diplochila (Carabus) impressa,** p. 57. (Daldorff.) Type at Copenhagen.

The species was redescribed by Dejean (Spec. Gen. ii, 1826, 383), and has been mentioned by various other writers. Nearly all the specimens I have seen came from Bengal or Burma, but the range is probably a wider one: Redtenbacher (Reis. Novar. Zool. ii, Col. 1867, 10) mentions the Philippine Is., examples in the Indian Museum are labelled China, and in the Hope Dept. of the Oxford University Museum are others labelled Madras and Singapore. I think these indications should be viewed with caution.

32. **Chlaenius (Carabus) posticus,** p. 57. (Daldorff.) Type at Copenhagen.

This species is mentioned by Chaudoir in his Mon. des Chléniens (Ann. Mus. Civ. Gen. 1876, 55) as being probably allied to *C. neelgheriensis* Guér., but the identification, based on the comparison of an example from Zanzibar

with an assumed typical specimen of Fabricius' species in the Berlin Museum, was due to Gerstaecker, and the question is left an open one. I find that the two species are in fact identical. A full description, along with the synonymy, will be found in Chaudoir's Monograph. It is a common insect throughout India and Ceylon, but does not apparently occur elsewhere, though there are two examples labelled China in the British Museum. The Zanzibar insect probably belongs to an allied species.

33. **Platymetopus (Carabus) flavilabris,** p. 59. (Daldorff.) Type at Copenhagen.

Schaum indicated the genus, but no one seems to have ventured on identifying the species. For years past I have endeavoured to persuade myself that the various described species in this genus were really distinct, and I myself (1919, 151) gave a detailed description of *P. punctulatus* Macl., comparing it with *P. senilis* Nietn.

I have seen in various collections a very large number of examples from India, Ceylon, Burma, Java, Sumatra, Siam, Indo-China, S. China, and Japan. I note considerable variation in specimens from the same locality, chiefly in the size, colour of the legs, amount of puncturation on the prothorax, and the extent to which the odd intervals of the elytra are raised. The conclusion is forced upon me that the following all belong to the same species: *flavilabris* F., *thunbergi* Quens., *punctulatus* Macl., *senilis* Nietn., *corrosus* Bates, and *punctulicollis* Bates. I have seen all the types, with the single exception of *P. senilis*. The species should be known as *P. flavilabris* F. The type has flavous legs (as in *senilis*), the head is very wide and minutely punctate, the prothorax only strongly punctate in the basal foveae and marginal channels, which are faintly blue in front, elytral intervals all flat.

34. **Barysomus (Carabus) semivittatus,** p. 59. (Daldorff.) Type at Copenhagen.

Redescribed by Dejean (Spec. Gen. iv, 1829, 60). Nietner also described the species under the name of *Oosoma gerstaeckeri* (Journ. As. Soc. Beng. 1857, ii, 147; id. Ann. Mag. Nat. Hist. (2), xx, 1857, 370). It is recorded from India, Ceylon, Indo-China, and Hong-Kong, but does not appear to be common in any of these localities.

35. **Stenolophus (Carabus) smaragdulus,** p. 60. (Daldorff.) Type at Copenhagen (1919, 178 and 189).

Both Schaum and Erichson (Käf. Mark Brand. i, 1837,

59) were at fault here. Motchulsky proposed a new genus *Egadroma* for the species. I have already commented on it and have only to add that, having now seen the types both of this species and 5-*pustulatus* Wied., my impression that these were only different forms of one species is confirmed. In the Fabrician type the interval between the two yellow apical spots is itself faintly yellow.

36. **Ophionea (Cicindela) cyanocephala,** p. 60. (Daldorff.) Type at Copenhagen.

A very well-known and widely-spread Eastern species, which seems to have been previously described by Thunberg (Nov. Ins. Spec. part 3, 1784, 68, f. 81). It has been redescribed by Dejean (Spec. Gen. i, 1825, 173), Brullé (Hist. Nat. des Ins. iv, 1834, 139, t. 4, f. 3), and Schmidt-Goebel (Faun. Col. Birm. 1846, 20). The figure given by Lacordaire (Gen. des Col. Atl. t. 3, f. 2) does not represent this species, as alleged, but *O. nigrofasciata* Schm.-Goeb.

(6) Systema Eleutheratorum, i (1801).

37. **Chlaenius (Carabus) quadricolor,** p. 180. (Lund-Daldorff.) Type at Copenhagen (1919, 139).

The specimen from which Fabricius drew up his description agrees with the traditional *C. quadricolor* Oliv.: Mr. Henriksen has kindly compared with it an example which I sent him.

38. **Catascopus (Carabus) elegans,** p. 184. (Daldorff.) Type at Copenhagen (1919, 141 and 182).

Schaum was wrong in supposing the species identical with *C. smaragdulus* Dej. Weber (Obs. Ent. 1801, 45) had described the species a few months, apparently, before Fabricius' volume appeared. I need only add to my previous notes that Chaudoir has given a very detailed description (Bull. Mosc. 1850, ii, 354).

39. **Callida (Carabus) splendidula,** p. 184. (Schestedt.) (1919, 165).

The specimen at Copenhagen was taken by Daldorff, and may be the type, but for some reason not now ascertainable it is not so marked; there is no example at Kiel.

40. **Strigia (Carabus) stigma,** p. 192. (Daldorff.) Type at Copenhagen.

It was a long time before this species was put into its present genus, and Motchulsky proposed for it (Et. Ent. 1855, 45) the new genus *Selenidia*. Chaudoir saw that it was a true *Strigia* (Rev. et Mag. Zool. 1872, 140), and

later on redescribed it (Bull. Mosc. 1878, iii, 9). His specimen came from Dacca, but the few examples I have seen all came from South India.

41. **Chlaenius (Carabus) pudicus,** p. 193. (Schestedt.) Type at Copenhagen.

Chaudoir did not know the type and in his Mon. des Chléniens (p. 280) he unwisely assumed that it was identical with Motchulsky's *Callistoides malachinus* (Bull. Mosc. 1864, iv, 335), which is not the case. It is in fact the same species as Bates' *C. caeruleiceps* (Ann. Mus. Civ. Gen. 1892, 320), a cotype of which I took with me for comparison. Fabricius' type came from Bengal, Bates' specimens from Karin Cheba: I have seen no other examples.

42. **Dischissus (Carabus) notulatus,** p. 201. (Schestedt.) Type at Copenhagen.

We are indebted to Schaum for the identification of this species with *Craspedophorus elegans* Dej. (Spec. Gen. ii, 1826, 290). Chaudoir accepted Schaum's statement, as appears both in his Revision of the genus *Panagaeus* (Bull. Mosc. 1861, iv, 335) and his Mon. sur les Panagéides (Ann. Soc. Ent. Belg. 1878, 104). I took with me to Copenhagen a specimen already compared with Dejean's type, only to find that the Fabrician species was quite a different one and, having a cleft fourth tarsal, did not even belong to the genus *Craspedophorus*. On my return I sent to Copenhagen three examples of the genus *Dischissus*, and as a result of Mr. Henriksen's comparisons with the type and my own notes I feel little doubt that the species is identical with *D. longicornis* Schaum (Berl. Ent. Zeit. 1863, 84). I have not, however, seen the type of this species, which is presumably in Berlin.

As a result of the above, my former note on this species (1919, 163), to the effect that it should be included in *Craspedophorus*, must be withdrawn.

43. **Pachytrachelus (Carabus) angulatus,** p. 203. (Daldorff.) Type at Copenhagen (1919, 125).

I have already pointed out that Fabricius described two quite different species under the same name of *Carabus angulatus*, this being the later one. I anticipated that it was the same thing as Dejean's *P. oblongus* (Spec. Gen. v, 1831, 813), a specimen of which, already compared with the type, I took with me for comparison. This proves to be the case, and the species should bear Dejean's name.

It is very variable in regard to colour, being sometimes of a uniform light brown, sometimes almost black: the usual coloration is dark brown or black, with a light border, a little interrupted in the middle, on the elytra. This is the coloration in the type, which is 5·5 mm. in length. The sculpture of the head and prothorax is a little variable, the head being often flattened in front and subrugose; in the type the head is convex and nearly smooth, while the prothorax is rather more finely punctate than is usual. The species occurs all over S.E. Asia, including the Philippine Is. and the Malay Archipelago.

44. **Omphra (Galerita) attelaboides,** p. 214. Type in Kiel University Museum.

In the Banks collection in the British Museum there is a specimen of an American insect described by Fabricius (Ent. Syst. i, 1792, 132) as *Galerita attelaboides*, and it belongs to the genus in which he placed it. In Syst. Eleuth. the same name reappears, followed by "Mus. Dom. Banks," but the description is of a different insect. Schaum fell into this trap (Stett. Ent. Zeit. 1847, 49), but was corrected by Erichson (l. c. 141), who informs us that the insect in question is *Omphra* (*Helluo*) *pilosa* Klug (Jahrb. Ins. 1834, 71). I do not know Klug's types in this genus, and am unable to express any opinion. I have not seen the Kiel specimen, and Mr. Henriksen informs me that he is unable to find any species of *Omphra* at Copenhagen bearing the name *attelaboides* F.

45. **Omphra (Galerita) hirta,** p. 214. (Lund-Daldorff.) Type at Copenhagen.

Redescribed by Dejean (Spec. Gen. i, 1825, 284), and by Klug (Jahrb. Ins. 1834, 71); Chaudoir has also made some remarks on the species (Rev. et Mag. Zool. 1872, 140). It is curious that Fabricius himself, Klug, and Chaudoir all say that the colour of the pubescence is grey; Dejean says it is brown, and I find that it is in fact quite light brown.

I believe the species to be confined to the South of India and Ceylon. There is an example in the British Museum labelled Burma, and two examples at Oxford are labelled Bengal and Penang respectively: I think these indications are erroneous, though the range of the species may possibly extend to Bengal.

46. **Siagona (Galerita) plana,** p. 216. (Schestedt-Daldorff.) Type at Copenhagen.

This species is the same as *S. plagiata* Chaud. (Mon. des Siagonides, Bull. Mosc. 1876, i, 93). This comparatively scarce species is found chiefly in South India and Ceylon, though I have seen one example from Orissa. Chaudoir's type was said to come from Dacca.

The name of *S. plana* Bonelli (Obs. Ent. ii, 1813, 458) being thus preoccupied, I propose for it the new name of *S. pumilus*.

47. **Siagona (Galerita) flesus,** p. 216. (Lund-Daldorff.) Type at Copenhagen.

Redescribed by Dejean (Spec. Gen. i, 1825, 363) and by Chaudoir (Mon. des Siagonides, p. 94). It is a common species, spread over India, Burma, the F.M.S., Siam, and Indo-China.

48. **Pheropsophus (Brachinus) annulus,** p. 217. (Lund.) Type at Copenhagen.

Chaudoir could make nothing of this species (Mon. des Brachynides, Ann. Soc. Ent. Belg. 1876, 47), nor has any other author attempted to identify it. I find it to be a curious aberration, such as I have seen in no other example of the genus, the shoulder and median spots being united on each side by a line down the middle of the elytron, thus forming a ring on each shoulder. The vertex is black, but not the front; there is a little yellow on the sides of the prothorax, and the sides and apex of the elytra are bordered with yellow, the latter rather narrowly. The head beneath, sides of procpisterna, metasternum, and metepisterna, pygidium, propygidium, and hind coxae are yellowish, the knees faintly fuscous. In structure the specimen agrees with *P. tripustulatus* F., of which I consider it to be an aberration.

49. **Melaenus (Brachinus) piger,** p. 219. (Sehestedt-Daldorff.) Type at Copenhagen.

Erichson (Stett. Ent. Zeit. 1847, 142) pointed out quite correctly that this species was closely allied to *Melaenus elegans* Dej. (Spec. Gen. v, 1831, 482), but no other description has appeared, and I therefore give one at the end, together with some further account of the genus.

The species is spread all over India, and Mr. E. A. D'Abreu has taken many specimens at Nagpur. I found it commonly at Belgaum many years ago during the rains, along with various species of *Siagona*, in the rubbish along the sides of the paddy-fields.

50. **Mastax (Brachinus) histrio,** p. 219. (Lund-Daldorff.) Type at Copenhagen.

Redescribed by Chaudoir in his Mon. des Brachynides (Ann. Soc. Ent. Belg. 1876, 101). Confined apparently to India and Ceylon, and not very common.

Wiedemann.

All the types of Wiedemann were in the Westermann collection and are at Copenhagen; more than half of them have been correctly identified, so that on these my notes will be brief. All the specimens came either from Bengal or from Java. The descriptions, which are in German, were drawn up between 1819 and 1824, and, considering when they were written, they are reasonably good: as a rule I have found it possible to recognise the species without any great difficulty. I give a list below, taking the species —as in the case of the Fabrician types—in chronological order. There are but few species to redescribe, partly because the original descriptions are sufficiently accurate, but much more because Westermann sent so many examples to Dejean, who redescribed them in his well-known Species Général des Coléoptères.

(1) Zoologisches Magazin, i, 3 (1819).

1. **Catascopus (Carabus) facialis,** p. 165. Bengal (1919, 130, 132, 141, and 202).

Redescribed by Dejean (Spec. Gen. i, 1825, 329), Brullé (Hist. Nat. des Ins. iv, 1834, 232), and Chaudoir (Bull. Mosc. 1850, ii, 352). A very common species throughout S.E.Asia.

2. **Chlaenius (Carabus) apicalis,** p. 166. Probably Bengal, though in this instance no locality is given.

Redescribed by Dejean (Spec. Gen. ii, 1826, 324) and Chaudoir (Mon. des Chléniens, p. 89). Confined to Northern India and Burma. Bouchard (Ann. Soc. Ent. Fr. 1903, 171) mentions Java as a locality, but probably he had before him *C. apicalis* Macl. (= *mutatus* Mun. Cat.).

3. **Orthogonius (Carabus) duplicatus,** p. 166. Java.

This species has been misunderstood by all the authors who have dealt with it, excepting only Dejean (Spec. Gen. i, 1825, 279), and his specimen came direct from Westermann. Wiedemann's description is certainly in this case misleading, which no doubt accounts for the existing confusion. After Dejean, Schmidt-Goebel next considered the species, and decided on making a new genus *Apsectra* (Faun. Col. Birm. 1846, 61) for the insect which he erroneously identified with it. Just before (p. 57) he had described

his *O. punctipennis*, which (if the traditional identification of his species is accurate) he quite correctly supposed to be the *duplicatus* of Dejean. Chaudoir in his Essai monographique sur les Orthogoniens (Ann. Soc. Ent. Belg. xiv, 1871, 99) rightly changed the name of Schmidt-Goebel's *Apsectra duplicata* to *Orthogonius schmidt-goebeli*, but made the mistake (p. 102) of identifying Wiedemann's *duplicatus* with the same author's *alternans*. Bates thought all these authors were wrong (Ann. Mus. Civ. Gen. 1892, 399), but it is difficult to know what he had in his mind: I have in my collection two examples (♂♀) from the Fea collection, presumably identified by him (though the labels are not in his handwriting), of which the ♂ is *O. mellyi* Chaud. and the ♀ *O. alternans* Wied.

The species is known at present as *O. punctipennis* Schm. Goeb., an example of which has been compared by Mr. Henriksen with the type of *duplicatus*: Wiedemann's name should in future be substituted for Schmidt-Goebel's. It is a common insect in North India, but I have not seen examples from further south than the Central Provinces. It occurs also in Burma, the F.M.S., and Indo-China. The type was said to come from Java, but I have seen only one other specimen (in the Chevrolat collection at Oxford) alleged to come from that locality, and I think it quite possible that it really came from Bengal.

4. **Orthogonius (Carabus) acrogonus,** p. 167. Java (1919, 165).

I need not repeat here the references given in my former paper.

5. **Cyclosomus (Scolytus) suturalis,** p. 169. Bengal.

This species has previously been identified with *C. flexuosus* F. (see above Fabricius, No. 6), but it is actually the same species as Motchulsky's *C. marginatus* (Bull. Mosc. 1864, iii, 200), redescribed by Chaudoir in his Étude monographique des Tetragonodérides, etc. (Bull. Mosc. 1876, iii, 32). Wiedemann's name must now displace Motchulsky's. In the type the median black fascia on the elytra is exceptionally narrow. The species is spread over North India and Indo-China.

(2) Magazin der Entomologie (Germar) iv (1821).

6. **Chlaenius nigricans,** p. 110. Bengal.

Redescribed by Dejean (Spec. Gen. ii, 1826, 371), and by Chaudoir (Mon. des Chléniens, 126).

One of the best known Eastern *Chlaenius*, which extends

all over S.E. Asia. Bates' *C. culminatus* (Trans. Ent. Soc. Lond. 1873, 251) is not more than a local race.

7. **Chlaenius rufithorax,** p. 112. Bengal.

Also redescribed by Dejean (Spec. Gen. ii, 1826, 322), and by Chaudoir (Mon. 259). I am indebted to M. René Oberthür for the only other example I know of this species, which came from Assam (Noa Dehing Valley), and which I compared with the type.

8. **Systolocranius (Oodes) linea,** p. 113. Bengal.

Described by Dejean (Spec. Gen. ii, 1826, 376) as *Oodes grandis:* I have compared the same specimen with both types. Chaudoir redescribed it in his Mon. des Oodides (Ann. Soc. Ent. Fr. 1882, 331). Confined to North and Central India.

9. **Simous (Oodes) nigriceps,** p. 114. Bengal.

Described by Dejean as *Oodes pulcher* (Spec. Gen. ii, 1826, 375). Here again I was able to compare the same specimen with both types. See also Chaudoir (Mon. 375). Confined to North India, but there is a specimen labelled "Pegu" in the Indian Museum apparently belonging to this species.

10. **Chlaenius (Carabus) xanthospilus,** p. 115. Bengal.

Redescribed by Nietner as *C. quinquemaculatus* (Journ. As. Soc. Beng. v, 1856, 386; id. Ann. Mag. Nat. Hist. (2), xix, 1857, 242). See also Chaudoir (Mon. des Chléniens, 285). The species seems to be fairly common throughout continental S.E.Asia.

11. **Brachynus longipalpis,** p. 118. Bengal.

Redescribed by Dejean (Spec. Gen. i, 1825, 314), and by Chaudoir in his Mon. des Brachynides (Ann. Soc. Ent. Belg. 1876, 87). The specimens I have seen all came from Bengal or the Himalayas, except some in the Oxford University Museum (Hope Dept.) labelled "Madras"—probably in error.

(3) Zoologisches Magazin, ii, 1 (1823).

12. **Distichus (Scarites) parvus,** p. 37. Bengal.

Chaudoir, though with some doubt, identified this species with his *Scarites opacus* (Mon. des Scaritides, Ann. Soc. Ent. Belg. 1880, 103), and the description rather lends itself to this interpretation. It is in fact identical with Chaudoir's *Distichus lucidulus* (l. c. p. 57), and his name must give place to Wiedemann's. Mr. Henriksen has kindly compared with the type a specimen which I had already compared with Chaudoir's type.

The species ranges from Bengal, through Burma and Siam, to Indo-China, but there are in the Indian Museum two specimens taken by Dr. N. Annandale at Tenmalai, Western Ghats, so that it is probably more widely spread in India than existing records indicate.

13. **Oxygnathus (Scarites) elongatus,** p. 38. Bengal.

Redescribed by Dejean (Spec. Gen. ii, 1826, 171), and by Brullé (Hist. Nat. des Ins. v, 1835, 67).

See also Putzeys (Postscr. ad Cliv. Mon., Mém. Liège, xviii, 1863, 5, t. 1, f. 1). The type measures 12 mm. in length, and the specimen I took to Copenhagen for comparison measures only 8 mm. They appeared to me to belong to the same species, and I find that I have in my collection an example measuring 10·5 mm. I conclude that it varies a good deal in size. The only specimens I have seen, other than the type, were taken by the late Mr. G. Q. Corbett in various localities in Burma, where also it was taken by Mr. Fea (see Bates, Ann. Mus. Civ. Gen. 1892, 274).

14. **Scarites punctum,** p. 38. Bengal (1919, 162).

Chaudoir could make nothing of this species (Mon. des Scaritides, 1880, 127). I recently expressed the opinion that it would probably prove to be identical with Chaudoir's *Distichus puncticollis*, but this was not a good guess, for it turns out to be Chaudoir's *Scarites opacus* (l. c. 103). Confined to North India and not apparently a common species.

I take this opportunity of correcting an inadvertence in my former paper. I said, referring to Macleay's citation of Wiedemann's *S. punctum*, "which comes from Bengal and not Senegal as indicated." I had at the time only Lequien's French translation of the Annulosa Javanica, in which "Senegal" is substituted for "Bengal"; in the original English edition, which I now have, the locality is quite correctly given.

15. **Macrochilus (Helluo) impictus,** p. 49. Bengal.

Redescribed by Dejean (Spec. Gen. i, 1825, 287) on a specimen sent to him by Westermann and alleged to come from Java. I have seen examples from various Indian localities, rarely more than one at a time, but none from Java, which I consider in all probability a mistake for Bengal. See also Andrewes (Ann. Mag. Nat. Hist. (9) vi. 1920, pp. 497 and 503).

16. **Creagris (Helluo) distacta,** p. 49. Java (1919, 169).

I knew that this species belonged to the genus *Creagris*, for some little time ago Dr. Lundbeck had, at my request,

examined the type and informed me that the fourth tarsal was bilobed. There are two examples in the British Museum, which I had already identified as Wiedemann's species : I took one of these to Copenhagen for comparison and found that it agreed exactly. Wiedemann's description is rather short, and, as no one else has redescribed the species, I do so at the end of this paper.

17. **Oodes virens,** p. 50. Bengal.

Chaudoir omits all reference to this species in his Mon. des Oodides (Ann. Soc. Ent. Fr. 1882), but this work was published after his death. It is identical with his *Oodes varians* (l. c. 352), so that Wiedemann's name must replace his. Chaudoir's specimen also came from Bengal. I have only seen four other examples, viz. two from Assam (Indian Museum and Pusa Coll.), one from Burma (my own collection), and one from the Philippine Is. (Brussels Museum). I compared my own example with both types.

18. **Chlaenius chalcothorax,** p. 51. Bengal.

This species presents some difficulties. Wiedemann described a ♂ specimen, but in the Copenhagen Museum there are two specimens (♂ ♀) side by side, the type label being attached to the ♀. There is a considerable difference in the size of the insects, the ♂ being 16 mm. long and the ♀ 20 mm.; I do not think that they belong to the same species, and I consider the ♂ example to be the type of Wiedemann's species.

Chaudoir supposed that his *C. pubipennis* (Bull. Mosc. 1856, iii, 233) was the same species as Wiedemann's (see Mon. des Chléniens, 138), and I took to Copenhagen an example, previously compared with Chaudoir's type, for comparison. The specimens do not agree, *C. chalcothorax* (♂) being a little larger, the sides of the prothorax hardly sinuate before the hind angles, its surface more sparsely but much more coarsely punctate, the base more evidently bordered, the elytra darker and with the puncturation more aciculate. The ♀ Copenhagen example, in addition to the much larger size, has the sides of the prothorax distinctly sinuate before the hind angles, with the basal foveae larger and shallower than in the ♂; the elytra are browner in colour, more dilated behind, and more coarsely punctate, in addition to which they have a yellow border, thus excluding *C. macropus* Chaud., and its allies. I found that I had in my collection a specimen, labelled India, apparently agreeing with Wiedemann's ♂; I sent this to

Mr. Henriksen for comparison, and he informs me that it agrees exactly. He also adds, "Wiedemann saw both specimens, as he determined all Westermann's insects; the labels are written and arranged by Westermann, and the transposition of the labels must thus be due to him, as this part of his collection has not yet been altered."

19. **Lomasa (Chlaenius) xanthacrus,** p. 51. Bengal.

Redescribed by Redtenbacher as *Chlaenius huegeli* (Reis. Novar. Zool. ii, 1867, Col. 9). I recently described a new genus for the species (Ann. Mag. Nat. Hist. (9), iii, 1919, 479). I have seen a number of specimens labelled "India," but the only exact localities I know are Calcutta and Karachi.

20. **Orthogonius (Plochionus) alternans,** p. 52. Java (1919, 165).

Redescribed by Dejean (Spec. Gen. i, 1825, 280). See also Brullé (Hist. Nat. des Ins. iv, 1834, 225, t. 8, f. 1), E. Desmarest (Voy. la Bonite 1841, 291, t. 2, f. 1), Schmidt-Goebel (Faun. Col. Birm. 1846, 60), and Chaudoir (Essai monographique sur les Orthogoniens, Ann. Soc. Ent. Belg. xiv, 1871, 102). After seeing Wiedemann's type, I am convinced that Macleay's *O. alternans* (= *macleayi* Andr.) (Ann. jav. 1825, 27) is a distinct species.

I have seen examples from Java, Sumatra, Burma, and Assam; according to E. Desmarest, the species is also found in the Philippine Is.

21. **Chlaenius (Harpalus) leucops,** p. 52. Bengal.

Described by Chaudoir under the name of *C. aeruginosus* (Bull. Mosc. 1856, iii, 271): subsequently and quite correctly identified by its author with Wiedemann's species. I have compared the same specimen with both types.

Very widely spread over S.E. Asia, including the Philippine Is. and Malay Archipelago, but apparently not common anywhere.

22. **Hypharpax (Harpalus) dentipes,** p. 54. Java (1919, 158).

I need not repeat here the synonymy and other particulars given in my former paper.

23. **Craspedophorus (Panagaeus) geniculatus,** p. 56. Bengal.

This species was unknown to Chaudoir, who thought it might be identical with *C. hilaris* Laf. (Mon. sur les Panagéides, Ann. Soc. Ent. Belg. 1878, 112). This is not the case, and, as no other description has appeared, I describe at the end the only other specimen I have seen

(Pusa Coll.), which I took with me to Copenhagen and compared with the type.

24. **Callistomimus (Panagaeus) chalcocephalus,*** p. 57. Java (1919, 136).

This proves to be *Callistomimus* (*Pristomachaerus*) *messii* Bates (Trans. Ent. Soc. Lond. 1873, 324), described from Hong-Kong, but ranging across Southern China to the Himalayas and Burma. A local race, Bates' *C. quadristigma* (Ann. Mus. Civ. Gen. 1892, 303), also occurs in Burma, and has been found by Mr. R. Vitalis de Salvaza in Laos. I have seen no other examples from Java, and, as Wiedemann was in the same paper also describing specimens from Bengal, it seems possible that some mistake may have been made regarding the locality.

I have seen examples from Hong-Kong, Tonkin (*R. Vitalis de Salvaza*), Burma—Maymyo (*H. L. Andrewes*), Sikkim—Gopaldhara (*H. Stevens*), Kumaon—W. Almora (*H. G. Champion*), and Dehra Dun. In writing his paper on the Scientific Results of the Second Yarkand Mission (Col. 1891, p. 4), Bates—for reasons which I am not able to fathom—attributed a specimen taken in the Jhelam Valley to Wiedemann's species, which he did not know, rather than to his own *C. messii*. This specimen, now in the Indian Museum collection, has lost both head and prothorax, but, judging by the elytra, I have no doubt that the species is the same. Kollar did not know the locality of his *Panagaeus chlorocephalus* (Ann. Wien. Mus. i, 1835, 335, t. 31, f. 4), but it seems probable that it will prove to be the same species.†

25. **Badister thoracicus,** p. 57. Bengal.

I thought I recognised this species, and took over with me an example which I found to correspond exactly with the type. No other description has appeared, and I have therefore redescribed it at the end.

I have seen examples in the British Museum from Bengal—Berhampur, and in the Indian Museum from Calcutta, some "at light" (*F. H. Gravely*).

26. **Stenolophus (Badister) quinquepustulatus,** p. 58. Bengal (1919, 178 and 189).

* Already referred to in my note on the genus *Callistomimus* (see note on p. 146).

† I have recently sent an example of Wiedemann's species to Vienna, and Dr. Holdhaus has kindly compared it with Kollar's type. This is unfortunately a wreck, unfit for transport, so that I have not seen it, but Dr. Holdhaus' comparison has convinced him that the two species are different.

See Fabricius No. 34. *Stenolophus smaragdulus*. The type of this extremely common insect has the usual five testaceous spots on the elytra. It was redescribed by Dejean (Spec. Gen. iv, 1829, 414), and references to it are numerous. It occurs throughout the East.

27. **Abacetus (Badister) rubidicollis,** p. 58. Bengal.

I had no suspicion that this species, upon which no other author seems to have made any comment, would prove to belong to the genus *Abacetus*, and I had therefore no specimen ready for comparison. I had no doubt, however, of its identity with *A. quadrimaculatus* Chaud. (Essai monographique sur le genre *Abacetus*, Bull. Mosc. 1869, ii, 380), and have since sent to Copenhagen for comparison an example of Chaudoir's species already compared with his type. Mr. Henriksen tells me that the two specimens agree exactly.

The only precise locality I know for this species is Dacca (British Museum).

28. **Hexagonia (Lebia) longithorax,** p. 58. Bengal.

The example of this genus, which I had doubtfully identified with Wiedemann's species, proved to be something quite different. From notes which I made, and subsequent re-examination of a specimen already compared with the type of Chaudoir's *Hexagonia brunnea* (Bull Mosc, 1861, ii, 531), I came to the conclusion that the two species were the same. I sent the specimen to Copenhagen, where Mr. Henriksen compared it with Wiedemann's type, finding it to agree exactly. This identity was evidently suspected by Schaum (Berl. Ent. Zeit. 1863, 433).

The only exact locality I know is Dehra Dun (Forest Research Institute).

29. **Anchista (Lebia) brunnea,** p. 59. Bengal.

Another species upon which, so far as I know, no other entomologist has commented. I suspected its identity with Chaudoir's *Anchista picea* (Bull. Mosc. 1877, ii, 238), of which I took with me an example already compared with the type. I found the two specimens to correspond perfectly, so that Wiedemann's name, as the older, must replace Chaudoir's.

Chaudoir's insect came from Dacca, and I have others from Pusa and Nagpur.

30. **Promecoptera (Lebia) marginalis,** p. 60. Bengal (1919, 165).

A specimen was sent by Westermann to Dejean, who

founded upon it the genus *Promecoptera* (Spec. Gen. v, 1831, 444) and redescribed the species in some detail. I have seen both the types, but no other examples.

31. **Drypta flavipes,** p. 60. Bengal (1919, 170).

Redescribed by Dejean (Spec. Gen. ii, 1826, 442), and later by Chaudoir (Bull. Mosc. 1850, i, 33; id. ibid. 1861, ii, 548) as *D. pallipes*. I compared with Wiedemann's type a specimen already compared with Chaudoir's.

Common in North India, but not apparently occurring elsewhere.

Schmidt-Goebel (Faun. Col. Birm. 1846, 24) doubtfully identified Wiedemann's species with an insect from Bengal, which, owing to its pectinate claws, he put into his genus *Dendrocellus*. This is evidently quite another species, which I have not as yet been able to identify *; Chaudoir renamed it *D. rugicollis* (Bull. Mosc. 1861, ii, 546).

32. **Drypta aeneipes,** p. 60. Bengal.

No comment has appeared on this species, but Wiedemann's description is fairly good. Having the type before me, I took the opportunity of comparing it with an example of *D. lineola* Macl. *D. aeneipes* is a little smaller (8·0 mm.); the head, prothorax, and a fairly large discal patch on the elytra red, with a faint purple reflection, rest of elytra blue-green, legs aeneous, except base of femora. Head more convex, less punctate, genae longer, neck more constricted; prothorax more shiny, a little shorter, less punctate, relatively wider in front and a little more compressed behind; elytra much more finely striate, puncturation of intervals finer and more distinct, outer extremity of truncature hardly dentate, but forming a sharp angle. Bates' *D. fimbriata* (Ann. Mus. Civ. Gen. 1892, 384) from Burma is only a slight variety.

Since my return I have come across two specimens in the British Museum, which I had identified rather doubtfully with Wiedemann's species some little time ago and subsequently overlooked. One of them I sent to Copenhagen, and Mr. Henriksen tells me that, though the prothorax is a little narrower, it agrees very well with the type.

33. **Tetragonoderus (Bembidium) dilatatus,** p. 61. Bengal.

* Since the above was written, I have, thanks to Dr. Jan Obenberger of Prague, seen Schmidt-Goebel's type. I consider his species to be a colour variety only of *Desera geniculata* Klug.

Redescribed by Dejean (Spec. Gen. iv, 1829, 493) on an example sent to him by Westermann, and by Chaudoir in his Etude monographique des Tetragonodérides, etc. (Bull. Mosc. 1876, iii, 41). I have seen examples from many parts of India, to which this species seems to be confined.

34. **Tetragonoderus (Bembidium) punctatus,** p. 61. Bengal.

Also redescribed by Dejean (l. c. 505) on an example sent by Westermann, to which some further notes were added by Schmidt-Goebel (Faun. Col. Birm. 1846, 92), and by Chaudoir (l. c. 48). North India, Burma, and (according to Vuillet) Cochin China.

35. **Tetragonoderus (Bembidium) taeniatus,** p. 62. Bengal.

Hitherto unidentified, but the description is quite a fair one, and I found no difficulty in determining specimens received from Pusa and Chapra (Agric. Res. Inst.), one of which I took to Copenhagen for comparison. I have also seen one specimen from Kumaon (*H. G. Champion*), and there are a number of specimens labelled "India" in the British Museum. I hardly think it necessary to redescribe this species.

36. **Omophron (Scolytus) vittatus,** p. 69. Bengal.

Neither this nor the succeeding species seem to have been known either to Chaudoir (Note monographique sur le genre *Omophron*, Rev. et. Mag. Zool. 1868, 56) or to Dr. Gestro (Enumerazione delle specie del genere *Omophron*, Ann. Mus. Civ. Gen. 1892, 964). I believe this type to be a unique specimen, and I give a further description of it at the end.

37. **Omophron (Scolytus) pictus,** p. 69. Bengal.

Of this species a single example was sent to me some time ago by the Agricultural Research Institute, Pusa: this had been taken at Pusa "at light" (*H. Maxwell Lefroy*). I had already identified it rather doubtfully with *O. pictus*, but, on coming to compare it with the type, I found the identification to be correct. I have seen no other specimens. I give at the end some further notes on the species.

(4) Analecta Entomologica (1824).

38. **Catadromus (Harpalus) rajah,** p. 7. Java (1919, 148).

No doubt identical with *C. tenebrioides* Oliv., referred to in my former paper. In his Annulosa javanica, referring to his own example of *C. tenebrioides*, W. S. Macleay says (p. 18): "a piceous variety in my father's collection is the very specimen from which Olivier took his description and figure." Whether Macleay inherited his father's collection,

and, if so, whether he took it with him when he emigrated to Australia, are questions which I have at present no means of determining.

The type of Macleay's *C. tenebrioides* is in the British Museum, and I have compared other examples with Wiedemann's type, so that there is no doubt about the identification. The species is apparently confined to Java.

III.

Mr. E. Fleutiaux having kindly lent me the collection of Carabidae made by Commandant Delauney and Capt. R. de la Perraudière in Indo-China, and determined by Bates (Ann. Soc. Ent. Fr. 1889, 261–86), I take this opportunity of making a few comments suggested by a re-examination of the material, excluding species which I have dealt with elsewhere. I follow the sequence and give the numbers of the species as they appear in Bates' paper.

1. **Scarites mancus** Bonelli (p. 261) = *S. semicircularis* Macl. (Ann. Jav. 1825, 24). The species has been taken commonly by Mr. R. Vitalis de Salvaza in Tonkin, Annam, and Laos.

2. **Distichus** ?, (p. 261). Bates labelled this specimen "*Distichus* ? impossible de déterminer." I have compared it with an example of *D. lucidulus*, previously compared with Chaudoir's type, and can see no material difference. This species, as mentioned on a previous page, now takes the name of *D. parvus* Wied.

5. **Clivina bacillaria** Bates (p. 261). Although he gave this species a name, Bates differentiated it from *C. siamica* Putz. (as determined by him) only by its larger size and the shallow emargination of its clypeus. Though the prothorax and elytra are similar in form, it seems to me quite a distinct species. The head is relatively much wider, longer, and more roughly sculptured; frontal plates elongate, very little rounded at sides, with a sharp longitudinal ridge running to inner margin of eye; clypeus wide, its side extensions rather sharply angled, a well-marked transverse ridge in the middle; clypeal suture not so deep as in *siamica*, the whole front immediately behind it finely rugose and punctate (a single puncture in *siamica*). The prothorax is a little longer, and the spines on the intermediate tibiae are exceptionally long and strong. Not having yet seen Putzey's types of this genus (except

those at Oxford), I am unable to comment on the other species.

13. **Clivina trapezicollis** Bates (p. 263). Bates recognised in a subsequent note that this species belonged to Putzey's genus *Psilus*. M. Severin, of the Brussels Museum, has recently been good enough to send me the type of *P. acutipalpis* Putz. An examination of these two species leads me to the belief that Putzey's *Ardistomis paradoxus* (Ann. Soc. Ent. Belg. xi, 1868, 21), which he placed with great hesitation in this American genus, actually belongs to the genus *Psilus*, and may indeed be identical with Bates' species.

27. **Chlaenius javanus** Chaud. (p. 265) = *C. circumdatus* Brullé. I agree with Bates in regarding *C. xanthopleurus* Chaud., as a variety, or rather local race, spread throughout Indo-China, Siam, and Southern China; this form is found as far north as Korea (Coll. H. de Touzalin).

28. **Chlaenius cinctus** F. (p. 266). I gave some notes on this species in a former paper (Trans. Ent. Soc. Lond. 1919, 122), but did not there mention this reference of Bates. The Indo-Chinese species is not *C. cinctus* F., nor is it identical with the Indian *C. pulcher* Nietn. (= *C. cinctus* Chaud., not F.). In addition to the single example in the de la Perraudière collection, I have before me others taken in Annam, Tonkin, and Laos by Mr. R. Vitalis de Salvaza, and I describe them at the end under the name of *Chlaenius pulcher* Nietn. race *asper* nov. I have given a detailed description, as Nietner's is short, and Chaudoir confines himself to comparing the species with an African one.

32. **Simous aeneus** Laf. (p. 266). I have before me examples of Laferté's species from Java, and of *S. lucidus* Chaud. from Laos, compared with the respective types. In spite of the dark cupreous tinge of Bates' specimen, I have no hesitation in identifying it with *S. lucidus* and not *S. aeneus*.

35. **Eccoptogenius moestus** Chaud. (p. 267). As already mentioned, Bates evidently did not know this genus, which differs from *Diplochila* (*Rhembus*) in having the first antennal joint strongly clavate; this is not the case here. I doubt whether *Eccoptogenius* can be retained as a separate genus.

In addition to the single example in this collection, I have seen others taken by Mr. R. Vitalis de Salvaza in Laos and Cambodia. The species agrees closely with the

description of *D. laevigata* Bates (Ann. Mus. Civ. Gen. 1892, 326) except in one particular. Comparing his new species with *D. polita* F. (as then identified), he says, "labro et epistomate similiter emarginato," whereas in the Indo-Chinese specimens the emargination of the clypeus is very shallow. Mr. Fea took one example only of *D. laevigata* at Kaw Kareet, in Tenasserim, and until I have seen this type, I do not like to describe the species as new.

38. **Anisodactylus** ? (p. 268). I have recently described this species (Ann. Soc. Ent. Belg. 1920, 109) under the name of *Gnathaphanus festivus*.

45. **Platymetopus laetulus** Bates (p. 270) = *Dioryche amoena* Dej. The species is not compared with any other. Bates knew Dejean's species, and indeed mentions it a few lines further down, so that I am at a loss to account for the introduction of this superfluous name.

46. **Platymetopus indochinensis** Bates (p. 270). This species, like the last, belongs to the genus *Dioryche*. Bates complained of the inadequacy of Walker's descriptions, but here he has almost eclipsed Walker. The description is contained in two lines, and gives the impression that the species is very much like *D. amoena* Dej., differing in the colour of the first antennal joint and the obtuse hind angles of the prothorax.

It is a duller insect than *D. amoena*, cupreous without any greenish tinge; prothorax with smaller and deeper basal foveae, the sides not flattened out near hind angles, surface more (though sparsely) punctate, the fine basal puncturation confined to the foveae and the space between them, whereas in *amoena* it extends to the sides, leaving the middle of base with comparatively few punctures; elytra shorter and wider, the striae no deeper at apex than on disk, scutellary striole short, intervals rather flatter, 1 and 2 distinctly narrower than the others, punctures on 3, 5, and 7 much larger (though smaller on 7 than on 3 and 5), but fewer in number, minute puncturation identical.

54. **Anoplogenius renitens** Bates (p. 272). The specimen so named by Bates is another example of 52, *Anoplogenius microgonus* Bates, but *A. renitens* does occur in Indo-China.

58. **Acupalpus ovatulus** Bates (p. 273). Bates does not discuss the generic characters. The species has not the facies of *Acupalpus*, and the hind tarsi have a shallow groove on the outer side, a character foreign to that genus. On

the other hand, the fourth tarsal is only slightly emarginate, and the apex of the prosternal process (in the specimen dismounted for examination) is glabrous, so that it will not go into the genus *Stenolophus*. It does not seem wise, without more substantial characters to work on, to propose a new genus, so I leave the species provisionally where Bates has put it.

59. **Perigona ruficollis** Motch. v. **nana** (p. 273). In the Revue d'Entomologie 1907 Fauvel discusses this genus, and a specimen of *nana* sent to him for examination bears the label "*plagiata* Putz. ex. typ." (presumably compared with Putzey's type). As, however, Bates' v. *nana* is left by Fauvel (p. 100) as a var. of *ruficollis* Motch., it seems uncertain whether or not it is actually identical with Putzey's species.

60. **Perigona** ? (p. 274). This example was also sent to Fauvel and determined by him as "*P. litura* Perroud ex. typ."

62. **Tachys** ? (p. 274). Bates thought this was *T. pictipennis* Putz., or an allied species. I think probably the latter. I have an example which I identify with Putzey's species and which, like the type, comes from Celebes: in this the spots on the elytra are distinct, but in Bates' example the front and hind spots are joined, the sutural striae are less impressed and the surface more shiny. Without seeing the type, I cannot decide the point.

69. **Triplogenius buqueti** Cast. (p. 276) = 70, *Lesticus* (*Triplogenius*) *chalcothorax* Chaud. It is difficult to surmise why Bates should have picked out this example and labelled it *T. buqueti*. The species are closely allied, but can be readily distinguished by the form of the prothorax. Tchitcherin has already drawn attention to the misidentification (Hor. Soc. Ent. Ross. xxxiv, 1900, 177, Observ.), but without indicating the correct name.

71. **Abacetus marginicollis** Chaud. (p. 276). This is not the Burmese species. I have compared the specimen with an example of *A. aenigma* Chaud., from Hong-Kong, previously compared with the type: I find them to be exactly similar. Mr. R. Vitalis de Salvaza has lately taken it in some numbers in Laos and Cambodia.

74. **Abacetus lophoides** Bates (p. 277). In a subsequent paper (Ann. Mus. Civ. Gen. 1892, 362) Bates says of this species, "scarcely more than a local variety of *A. quadriguttatus*, having 2 instead of 3 apical antennal joints

albotestaceous." The solitary example has unfortunately no antennae left, but in some examples taken by Mr. R. Vitalis de Salvaza the 9th joint is light at the apex only. I consider it identical with Chaudoir's species.

75. **Abacetus** ? A unique example of an undescribed species.

76. **Abacetus** ? This agrees with examples of *A. chalceolus* in my collection, coming from various localities, one of which I have compared with Chaudoir's type. Mr. R. Vitalis de Salvaza has taken it both in Laos and Cambodia.

78. **Holconotus ferrugineus** Chaud. = *Fouquetius crassimargo* Tchitch. (Ann. Soc. Ent. Belg. 1898, 453). Tchitcherin's memoir on *Holconotus* gives all necessary details, but this generic name being preoccupied, Maindron's *Fouquetius* should be used.

81. **Diceromerus chaudoiri** Flt. = *D. orientalis* Motch. (Et. Ent. 1859, 35). I do not regard this as other than an immature example of Motchulsky's species.

83. **Colpodes** ? I cannot at present identify this unique example with any described species of the genus.

96. **Orthogonius profundestriatus** Schm. Goeb. Bates subsequently identified this species, no doubt correctly, with the same author's *O. puncticollis*. This, as mentioned on a previous page, is identical with *O. duplicatus* Wied.

112. **Crossoglossa latecincta** Bates = *Phloeodromius nigrolineatus* Chaud. (Bull. Mosc. 1852, i, 44). The width of the black, or dark green stripe, upon which Bates seems chiefly to have relied in characterising his species, is very variable. It may be broad, or narrow, or even disappear altogether. The genus *Phloeodromius* W. Macleay (1871) must be substituted for Chaudoir's *Crossoglossa* (1872). Mr. T. G. Sloane informs me (on the authority of Mr. J. J. Fletcher) that vol. ii, part 2, of the Trans. Ent. Soc. New South Wales, containing the description of Macleay's genus, appeared in 1871, though I cannot find that this is revealed by any internal evidence.

IV.

In July 1920 Prof. Y. Sjöstedt visited London, and at my request very kindly brought with him the types of some of the Oriental species described by Boheman (Eugenies

Resa 1861, Zool. Coleoptera) and also one by Quenselt, now in the Stockholm Museum.

I do not refer to most of them, which are sufficiently well known and accurately determined in various collections I have seen. I was able to compare with all the types examined, examples either in the British Museum collection or in my own, with the solitary exception of *Anchomenus limbatus* (*limbaticollis* Mun. Cat.), of which I have seen no other specimen. I may mention that *Platymetopus melanarius* proved, as I anticipated (1919, 150), to be identical with *Gnathaphanus vulneripennis* Macl., and *Harpalus subcostatus* Dej. *Drimostoma rufipes* (1919, 160) also proves to be identical with *Coelostomus picipes* Macl. Tchitcherin has already pointed out (Hor. Soc. Ent. Ross. xxxv, 1901, 166) that *Stenolophus biplagiatus* is an *Acupalpus*.

There is one species which has been misidentified, viz. *Anchomenus scintillans*, and requires therefore some further notice. In describing his *Anchomenus chalcomus* (Trans. Ent. Soc. Lond. 1873, 280) Bates says, "Very closely allied to the common Chinese *A. scintillans* (Bohem.), from which no difference is perceptible, except the abdomen being pitchy black (like the rest of the under-surface) instead of testaceous." This seems a slender foundation on which to establish a new species, but I have before me Chinese examples labelled *A. scintillans* Boh. in Bates' handwriting, and they certainly appear, apart from the rather lighter colour, identical with *A. chalcomus*. In the same volume of the Transactions (p. 330) Bates described his *A. aeneotinctus*, differentiating it from the species which he supposed to be *A. scintillans*. It is, in fact, identical with the true *scintillans*, so that Boheman's name must displace Bates', *A. scintillans* Bates in litt. (not Boh.) becoming a synonym of his *A. chalcomus*.

Descriptions of New and Other Species.

Siagona polita, sp.n. Length 20·0 mm. Width 6·5 mm.

Siagona atrata ‡Bates (not Dej.), Ann. Mus. Civ. Gen. 1892, 284.

Black: tarsi and palpi piceous.

Head wide (4·5 mm.), rather flat, smooth, with a few scattered punctures on vertex; lateral ridges uninterrupted, reaching basal sulcus, which is only moderately deep; eyes fairly prominent,

mandibles (♂) moderately dilated and bordered outwardly, a slight longitudinal prominence on middle of upper surface. *Prothorax* (5·5 mm. wide) cyathiform, side furrows deep, median line fairly deep and crenulate, surface almost impunctate, except along base and front margin. There is no stridulatory apparatus, which seems to be confined to certain N. African species. *Elytra* not quite twice as long as wide, shoulders well-marked, surface smooth, except for a few mingled large and small punctures at base and on shoulders (a few very small and inconspicuous punctures are visible here and there on disk).

The species is much like *S. atrata* Dej., but easily recognised by its smooth elytra. The eyes are more prominent, the side ridges of head are entire—not half-interrupted, as in *S. atrata;* the median line and side furrows of the prothorax are deeper on the disk, and the elytra are a little longer.

In addition to the specimens recorded by Bates (l.c. supra) from Rangoon and Tikekee, some of which (including the type) are in my collection, I have examples from Tharrawaddy and Paungde (G. Q. Corbett). In the British Museum there are examples from Pegu (*Atkinson*) and Rangoon, and in the Indian Museum also from Pegu and Rangoon (*Armstrong*). In the Hope Dept. at Oxford is a single specimen labelled "Ch." M. René Oberthür kindly gave me an example from Theinzeik, other specimens from the same locality being in his collection.

The species seems to be confined to Burma, whereas all the examples of *S. atrata* Dej. which I have seen come from Central and N.E. India.

Siagona apicalis, sp.n. Length 12·5 mm. Width 3·75 mm.

Siagona cinctella ‡Bates (not Chaud.), Ann. Mus. Civ. Gen. 1892, 285.

Piceous black: apex of elytra, metasternum, ventral surface, and tarsi dull red; hind trochanters light red.

Head (2·75 mm. wide) flat on vertex, side ridges uninterrupted, reaching mid-eye level, a shallow groove on their inner side, neck strongly constricted, surface moderately and uniformly punctate, with a small smooth patch on vertex, mandibles slightly dilated and bordered outwardly. *Prothorax* (3·25 mm. wide) short, sharply contracted behind, very little in front, median line very fine, the adjacent area longitudinally depressed, side grooves not very deep (for the genus), almost interrupted on disk, surface moderately and

fairly evenly punctate. *Elytra* very gently rounded, almost parallel, shoulders well marked, a shallow depression at a third from base, puncturation moderate, fairly close, and evenly disposed.

Bates (l.c. supra) has pointed out the differences between this species and *S. flesus* F., but the apical border is not light in colour, as in that species, but dull red, and extends from the apex only a short distance forwards along the sides. *S. cinctella* Chaud., as mentioned by Bates, is a much smaller insect; the puncturation is rather similar, but the surface is more shiny, and the apex of the elytra is much lighter in colour.

I have only seen examples from the Fea collection, two of which (including the type) are in my collection, another one being in the British Museum.

Chlaenius fastigatus, sp. n. Length 10·5–11·5 mm. Width 4·0–4·5 mm.

Chlaenius frater †Bates (not Chaud.). Ann. Mag. Nat. Hist. (5), xvii, 1886, 74.

Black: head and prothorax metallic green, latter darker with coppery reflections, elytra with a faint aeneous tinge, joints 1–3 of antennae, palpi, apex of elytra, and legs flavous, side border of prothorax and elytra dark red. Prothorax sparsely, elytra more closely but very shortly pubescent.

Head (1·90 mm. wide) convex, shiny, smooth, frontal impressions shallow, joints 3 and 4 of antennae equal, labrum truncate. *Prothorax* transverse (2·25 × 2·50 mm.), almost quadrate, convex and strongly declivous to front angles, extremities truncate, sides gently rounded, faintly sinuate close to base, front angles rounded, hind angles obtuse but well-marked; median line, transverse impressions, especially front one at its junction with median line, and basal foveae all deep, last named divergent towards apex; surface coarsely punctate at sides, in basal foveae, and along each side of median line, a smooth area on disk, which extends obliquely on each side to front angles. *Elytra* (4·0 × 7·0 mm.) ovate, convex, very slightly widened behind, sinuate near apex, which is rather pointed, but with a re-entrant angle at suture, border rounded at shoulder, punctate-striate, intervals a little convex, closely and finely punctate, apical border fairly wide, with a jagged edge in front (as in *C. frater*, *C. inops*, etc.). Under-surface punctate and pubescent, much less so along middle of ventral surface; prosternal process unbordered, metepisterna quite half as long again as wide.

Not unlike *C. frater* Chaud., but narrower, and with elytra more pointed behind, prothorax with slightly obtuse hind angles, punctures fewer and not quite so coarse, elytra not so finely punctate and consequently shinier.

Ceylon: Kandy (*G. Lewis*) 3 ex. ♂♀. The type is in the British Museum.

Pogonoglossus truncatus, sp. n. Length 9·5 mm.

Pogonoglossus validicornis ‡Bates (not Chaud.), Ann. Mus. Civ. Gen., 1892, 388.

Libresthis truncata Schm.-Goeb. Faun. Col. Birm., 1846, t. 2, f. 4 (fig. only).

Pitchy: legs testaceous red; joints 1–3 of antennae, palpi, side margin of prothorax, and ventral surface dull red. Body (except neck) clothed with short yellowish pubescence.

Head (2·0 mm. wide) shiny, moderately convex, with two deep foveae on front, neck very strongly constricted, genae bituberculate, sharply contracted behind, surface finely punctate at sides and behind, sparsely on vertex. *Prothorax* transverse (2·0 × 2·3 mm.), cordate, emarginate at apex, widest at a third from apex; sides strongly rounded in front, sinuate at some distance from base, with which they form a right angle, front angles a little advanced but not acute, lateral margins explanate and reflexed, strongly so at hind angles; median line and basal foveae well marked, surface moderately and a little irregularly punctate. *Elytra* (3·5 × 5·5 mm.) elongate, parallel, depressed at a third from base, truncate at apex, outer angles of truncature and shoulders strongly marked but rounded, apex with membranous border, crenulate-striate, intervals flat on disk, more convex at sides, finely but not very closely punctate, 3 tripunctate, 9 seriate-punctate, with some large umbilicate pores behind shoulders, from which and from others along sides issue a few very long fine hairs.

In *P. validicornis* Chaud., the prothorax is small, with quite inconspicuous angles, and the genae have a single tubercle.

The type, which is in my collection, is one of the examples taken by Mr. Fea at Meetan, Tenasserim. The species has also been taken by Mr. R. Vitalis de Salvaza at Hoabinh in Tonkin, and at various localities in Laos.

Genus Melaenus.

Ligula narrow, corneous, widened and hollowed out at apex, with a sharp longitudinal ridge beneath, truncate, bisetose; *paraglossae* whitish, filamentous, free, rather longer than ligula. *Maxillae* setose on inner side and in addition with a row of long bristles, apex bare, sharp, strongly hooked: outer lobe with two equal joints, stipes with a long bristle on outer side near base, another near apex. *Maxillary palpi* with antepenultimate rather longer than last joint, glabrous (except at apex), penultimate rather shorter than last joint, dilated towards apex, setose, last joint setose, a little inflated, truncate at apex: *labial palpi* with last two joints about equal in length, penultimate bisetose on inner side near apex, but with some smaller setae nearer base, last joint cylindrical, setose, contracted at base, subtruncate at apex. *Mentum* short, with a fine but well-marked suture, moderately emarginate, with a simple median tooth rather shorter than lobes, last named rounded at sides and apex, contracted towards base; epilobes very wide, rounded, extending far in front of lobes. *Mandibles* short, slightly hooked at apex, a seta in the scrobe, right one with two teeth near middle, left one with one tooth near base, upper surface longitudinally strigose. *Labrum* small, front angles rounded, slightly emarginate in front, sexsetose. *Antennae* reaching middle of elytra, joints 1–4 glabrous, 5–11 densely setose; 1 short, cylindrical, with a single seta on upper surface near apex, 2 very short, 3 and 4 with a few setae at apex, 3 equal to and 4 a little shorter than 1, 5–11 distinctly longer than 1, flattened, with a longitudinal ridge down the centre of each. *Eyes* very small, not prominent, distant from buccal fissure, one supraorbital seta; temporal suture visible beneath eye. *Prothorax* cordiform, a single seta on each side at a fourth from apex, none at basal angle, base bordered by very fine yellowish hairs, its sides oblique close to hind angles; front coxal cavities with a single internal opening. *Elytra* with base pedunculate, scutellum small, cordiform, inserted between elytra on their pedunculate part, sides sinuate before apex, and with an internal fold visible at that point; nine deeply punctured striae, 9 merged in 8 before reaching base, the united stria rounding the shoulder, and continuing to the point where the border ends over stria 5, 9 ending behind at the apical sinuation, 8 continuing to apex, scutellary striole wanting; base unbordered over first four intervals on each side, intervals 1–8 ending in a ridge behind, which runs parallel with apical border, so that striae 1–7 all end before apex, striae 1–4 have each a deep puncture in front of but detached from it; a few long setae, chiefly near base and apex, arising from a series of umbilicate pores on stria 9.

Underside with prosternal process widened between coxae, narrowed behind, again widened and truncate at apex; mesosternum emarginate behind, epimera not reaching coxal cavities, metepisterna long and narrow; ventral surface bordered throughout, last three segments transversely bordered. *Legs* with femora clavate; front tibiae deeply excised on inner side, tibiae slender, channelled, not dilated at apex, intermediate pair hollowed out externally at apex, with a fringe of yellow setae on outer margin of excavation; tarsi simple in both sexes, pilose on upper surface, joints decreasing in length from 1 to 4, 5 with setae beneath, approximately as long as 2 + 3 + 4; claws simple. Body glabrous. Insect winged.

Dejean described this genus in his Supplement (Spec. Gen. v, 1831, 481), immediately after three species of *Graniger* (*Coscinia*). Brullé also gave a description (Hist. Nat. des Ins. v, 1835, 85), correcting some errors made by Dejean. Lacordaire (Gen. Col. i, 1854, 166) placed it at the head of his *Ditomides*, remarking "*Melaenus* et *Coscinia* (surtout ce dernier) font le passage des *Siagonides* à la tribu actuelle." If his *Siagonides* are placed, as they now are, at the end of the Carabinae, this remark is in a measure true, for the genus should come near the beginning of the second great group into which the Carabidae are divided, *i. e.* Harpalinae of Dr. G. H. Horn, Carabidae Conjunctae of Mr. T. G. Sloane.

Melaenus piger F. Length 8–10 mm. Width 2·5–3·0 mm.

Dull black, sometimes with a faint purplish lustre; tarsi, labrum, palpi, and joints 5–11 of antennae brown, the last with a dense, short, yellowish pubescence.

Head convex (about 1·6 mm. wide), coarsely punctate, not at all contracted behind, sides forming a ridge in front of eyes, clypeus smooth, bisetose. *Prothorax* convex, slightly transverse (about 2·0 × 2·5 mm.), slightly emarginate both in front and at base, rather more contracted at base than at apex, sides rounded, hind angles forming a small rectangular tooth, front angles well marked, about rectangular; median line strongly impressed, not reaching extremities, basal foveae almost obsolete, surface rather coarsely punctate, a little more sparsely on disk. *Elytra* (about 3·0 × 5·5 mm.) moderately convex, parallel, shoulders well marked, border forming a blunt tooth, directed forwards, at the point where it terminates over stria 5, punctate-striate, striae deeper towards sides and apex, intervals gradually narrower and more convex towards sides. *Underside* coarsely punctate, but elytral epipleurae smooth.

The species is strikingly similar to *M. elegans* Dej., but the temporal suture, which runs back obliquely behind the eye in the African species, is here straight and much deeper (though not reaching base of neck); the elytral intervals also are more convex. The most noticeable difference, however, consists in the presence in *elegans* of a tubercle on the border of the prothorax in the sinuation before the hind angles, which in *piger* is altogether wanting.

Common throughout India, sometimes taken "at light."

Creagris distacta Wied. Length 10·0 mm.

Piceous: joint 1 of antennae (rest fuscous), apex of palpi, front margin of labrum, a spot on each elytron, and legs testaceous; rest of palpi and labrum, and base of ventral surface brown. Body shortly pubescent throughout, except labrum, underside of head, and procpisterna.

Head (2·0 mm. wide) shiny, rather flat, sparsely punctate, genae short, sharply contracted to neck, clypeus slightly emarginate, labrum depressed at sides, sexsetose, the two middle setae at extreme apex; mentum with a long and very sharp tooth, which is nearly as long as lobes, the tooth with a pair of setae at middle, and another pair at base; palpi short, stout, last joint moderately dilated and truncate at apex, antennae short, moniliform. *Prothorax* transverse (1·75 × 2·25 mm.), rather flat, cordate, base slightly produced in middle, a little emarginate at apex, sides rounded in front, then sinuate, front angles rounded, hind angles right, surface moderately and rather irregularly punctate. *Elytra* (3·0 × 5·5 mm.) flat, parallel, shoulders very square though rounded, truncate at apex, with outer angle of truncature rounded; seven well-defined crenulate striae, and a short scutellary striole between 1 and suture, 8 merged in 9, the whole lateral channel occupied by an uninterrupted series of large umbilicate pores, a row of closely placed punctures along each side of striae; intervals convex, 7 narrower than the others and subcarinate, 8 closely punctate; testaceous spots about middle of elytra, more or less rounded, covering intervals 3–7.

Much smaller than *C. binoculus* Bates, colour piceous, legs testaceous, antennae shorter and moniliform, genae contracted more abruptly to neck, prothorax much less transverse and less closely punctate, intervals of elytra more convex, spot rather smaller.

In addition to the type, I have seen two examples in the British Museum and one in the Brussels Museum: quite recently Mr. T. G. Sloane sent me two examples from Buitenzorg.

Craspedophorus geniculatus Wied. Length 11·0 mm.

Black: palpi testaceous, antennae, apex of femora, and tarsi brown, two spots on each elytron orange yellow. Pubescence short, greyish-yellow, but black on elytra (except over yellow spots).

Head small (1·8 mm. wide), flat, moderately constricted behind eyes, not narrowed behind, coarsely punctate, clypeus and neck smooth and polished, frontal foveae shallow, eyes very prominent; antennae long and filiform, joint 3 about half as long again as succeeding joints, palpi very long and slender, last joint securiform and obliquely truncate at apex; mentum very wide, sinus shallow, lobes short, rounded at sides and apex, mandibles sharply hooked at apex. *Prothorax* transverse (2·5 × 3·1 mm.), moderately convex, but a little explanate at sides, widest at middle, front angles rounded and inconspicuous, sides strongly and uniformly rounded, widely reflexed before hind angles, which are obtuse, but have a small acute tooth at the angle; median line and basal foveae well marked, the latter linear and slightly oblique, surface coarsely (more so than head) and more or less confluently punctate. *Elytra* (4·25 × 7·0 mm.) moderately convex, parallel, punctate-striate, intervals convex, finely punctate; front spot behind shoulder, extending from margin to stria 3, tapering a little inwards, hind spot smaller, quadrate, covering intervals 4–8. Beneath, the sterna and base of ventral surface at sides are coarsely punctate, rest of ventral surface finely punctate, base of ventral segments distinctly crenulate, metepisterna longer than wide. Tarsi beneath without special clothing of hairs. Insect winged.

In the form of the head and elytra hardly differing from *C. mandarinellus* Bates, but differing altogether in the shape of the prothorax, which in that species is much more narrowed in front than behind, widest considerably behind middle, with nearly rectangular hind angles, but without so acute a tooth, the surface more coarsely and much more confluently punctate.

Badister thoracicus Wied. Length 7·0 mm.

Blue black, iridescent; prothorax, two fasciae on elytra, with suture, margin, and epipleurae, first two joints of antennae (rest fuscous), palpi, clypeus, labrum, sterna, and legs testaceous red.

Head (1·5 mm. wide) moderately convex, smooth, opaque and very finely shagreened, clypeus with a pair of setiferous pores on hind margin, behind which the front is transversely channelled, eyes (for the genus) prominent, right mandible deeply emarginate.

Prothorax transverse (1·30 × 1·75 mm.), moderately convex in front, about equally contracted at extremities, but widest at a third from apex, which is strongly emarginate, base truncate but with oblique sides, sides well rounded in front, then straight to base, the oblique sides of which they join at an obtuse angle, strongly reflexed, a setiferous pore at hind angle and another at about a third from apex; median line faint in front, deep behind, basal foveae deep, rounded, surface smooth, with some faint transverse wrinkles, base subrugose. *Elytra* elongate-oval (2·3 × 4·2 mm.), finely striate, intervals quite flat, 3 with two pores at about a third from base and apex respectively: front fascia occupying the whole of the basal fourth of the elytra, and extending a little way back along the suture, hind fascia narrower, but widening out at the suture and sometimes interrupted on the middle of each elytron.

Allied to the Japanese *B. pictus* Bates, but larger and more iridescent: head larger and eyes more prominent, prothorax wider, its sides straighter behind, hind angles less obtuse and more strongly reflexed, elytra wider, more finely striate, the yellow fasciae and coloured sutural area much narrower.

Omophron vittatus Wied. Length 5·75 mm.

Pale straw colour: antennae and sides of prothorax dull orange, underside brown, the epipleurae of elytra and prothorax, and last two ventral segments rather lighter; transverse patches on back of head and middle of prothorax, both projecting forwards at middle, and a series of stripes on elytra dark green. These stripes occupy intervals 1, 2, 4, 6, and 10 from base to near apex; on 8 there are two short patches of colour, one at about a third from base, the other rather longer just behind middle; a stripe on 12 commences at a little distance from base and stops some way before apex, being interrupted at a fourth from base and just behind middle.

Head finely striate near eyes, coarsely but not closely punctate behind, the subocular ridge taking the form of a fine furrow with one or two coarse punctures, the surface close to the eyes coarsely punctate. *Prothorax* bisinuate in front, quadrisinuate behind, increasing gradually in width from apex to base; surface finely rugose-punctate, smoother at sides. *Elytra* with fifteen punctate striae, intervals smooth and shiny; only striae 1 and 2 reach the apex, 3 and 4 coalesce and join 2 near apex, 5, 6, 9, 10, 12, 13, 14, and 15 all end separately at some distance from apex, 7 and 8 are

very short and coalesce, 11 is very short but remains separate. Procpisterna smooth, except for a few punctures at base; metepisterna smooth, hardly longer than wide.

I know of no other species with a pattern like this, which, when further specimens are found, should render them easily determinable.

Omophron pictus Wied. Length 6·0 mm. Width 3·8 mm.

Testaceous: middle of underside and apex of mandibles dark brown: a patch at back of head, another on middle of base of prothorax, and an elytral pattern green. The last is more easily described if the elytra are considered as green, with testaceous pattern and border. A basal horse-shoe-shaped patch (convex forwards) over intervals 3–9, not quite reaching base, short on 6, longer on 7–9; a median patch on 3–5; an apical patch, not reaching the border, also on 3–5, longest on 3; a short patch on 7–9, just below the outside part of the basal patch, succeeded behind by another patch on the same intervals, which joins both the border and the apical patch; two side patches from interval 11 to border, just touching on 12, but distant on 13–14.

Head rather flat, smooth in front with faint cross-striation, wrinkled near eyes and finely punctate at back; subocular ridge extending inwards beyond buccal fissure, surface in front of it uneven, subpunctate near eye. *Prothorax* rather flat, bisinuate in front, base bisinuate on each side, increasing in width from apex to base, all angles acute; surface finely rugose, punctate in front, more coarsely along base, nearly smooth on disk; basal patch rather small, ill-defined, triangular, apex not quite reaching front margin. *Elytra* with fifteen punctate striae, 8 and 12 very short, intervals smooth but not very shiny, flat on disk, moderately convex at sides and towards apex. *Underside* smooth and shiny, a few coarse punctures on prosternal plate, sides of prosternum, base of procpisterna, sides of metasternum and basal segment of ventral surface.

In shape almost exactly like *O. maculosus* Chaud., but head and prothorax much less punctate, and the prothoracic green patch greatly reduced. The elytral pattern is not altogether dissimilar, but in *O. maculosus* the basal testaceous patch is small and covers intervals 7–9 only, the median and apical patches are less developed, the hind patch on 7–9 quite short, and interval 13 is green throughout.

Chlaenius pulcher Nietn. race **asper** nov. Length 18·0 mm. Width 7·75 mm.

Black: head and prothorax metallic green, both cupreous on disk, elytra greenish-black; epipleurae and margins of elytra to stria 8, margin of ventral surface, and legs (except coxae) flavous, palpi and antennae brown (latter lighter at base); underside slightly iridescent. Pubescence short, yellowish, rather sparse.

Head (3·3 mm. wide) rather flat, vertex finely rugose, some striation near eyes, punctate at back and sides, eyes prominent, joint 3 of antennae a third as long again as 4. *Prothorax* (4·75 mm. wide) slightly transverse, quadrate, flat but declivous to front angles, sides of base oblique, sides evenly rounded but rather wider at base than apex, hind angles obtuse and rounded, median line and basal foveae both clearly marked but shallow, surface finely rugose, coarsely punctate, more finely at sides, more closely along base. *Elytra* nearly parallel, but widest a little behind middle, border angled at shoulder, crenulate-striate, striae with a row of fine punctures along each side, intervals convex, rather coarsely punctate, odd ones slightly raised and more or less smooth along median line, 8 more finely and closely punctate. *Underside* smooth and polished along median line, prosternal process bordered and setose at apex, all episterna and sides of metasternum closely punctate, metepisterna not quite half as long again as wide, sides of ventral surface finely rugose, punctate near base. Front femora (♂) without tooth, tarsi glabrous on upper surface.

Closely allied to *C. pulcher* Nietn. (= *C. cinctus* Chaud., not F.), but that species is shorter (16 mm.), with smoother vertex, head, prothorax, and elytra more finely punctate, sides of prothorax slightly sinuate before hind angles, which therefore though obtuse are sharper, marginal channel narrower, especially behind. In *C. pulcher*, too, the elytra are generally a deeper black (sometimes bluish), and the even intervals, like the odd ones, are often smooth and polished along median line.

Tonkin: Hoabinh. Laos: Vientiane. Annam: Hué and Keng Trap (*R. Vitalis de Salvaza*). Cambodia: Pnomh-Penh (*Capt. R. de la Perraudière*). China (British Museum).

Note.—In Ann. Mag. Nat. Hist. (9), vii, 1921, p. 406, I recently described a species of *Omophron* under the name of *O. gemma*. I find this name is preoccupied, and I therefore desire to substitute for it the name of *O. gemmeus*.

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IV. *British* Limnobiidae: *Some Records and Corrections.*

By F. W. Edwards.

Plates I, II.

[Read March 16th, 1921.]

Since the late Mr. G. H. Verrall published his notes on the British Tipulidae (crane-flies) in the Entomologists' Monthly Magazine for 1885–7, very little work has been done on these insects in this country. Quite recently, however, Prof. de Meijere has undertaken a revision of the Dutch species, studying in particular the male hypopygium. His papers (published in the Tijdschrift von Entomologie, Deel lxii, 1919, pp. 52–97, pls. 2–10, Deel lxiii, 1920, pp. 46–86, pls. 2–10, and Deel lxiii, 1921, pp. 54–118, pls. 3–10) will be found indispensable to British students of the group, since the British and Dutch faunas are very nearly the same. With the following notes as a supplement to de Meijere's papers, the determination of the British Limnobiidae should now be comparatively easy. In the preparation of these notes the whole of the rather extensive collection in the British Museum has been studied, also the more limited material in the Cambridge and Edinburgh museums. The writer is further indebted to his friends Mr. H. Britten, Prof. J. W. Carr, Mr. A. E. J. Carter, Mr. C. A. Cheetham, Mr. J. E. Collin, and Mr. A. H. Hamm for the loan or presentation of material.

The result is that no fewer than 53 species are added to the British list, of which it has been found necessary to describe 14 as new. Unfortunately there are also a large number of changes in nomenclature to be made, all necessitated by a rigid application of the rule of priority. Though in the present writer's opinion there is much to be said against this principle, it seems at present the only way by which finality can be reached, and it is reasonable to hope that very few further changes will be needed in the future.

The present paper is in some sense a revision of the British Limnobiid fauna, but reference is omitted to those species which were satisfactorily dealt with by Verrall, and his papers must therefore be used in conjunction with this one. Treatment of the Tipulidae (in the restricted sense) is reserved for a future occasion.

This manuscript was already completed when I received Messrs. Goetghebuer and Tonnoir's "Catalogue raisonné des Tipulidae de Belgique" (Bull. Soc. Ent. Belg. II, 1920, pp. 104–112 and 131–147, pls. i, ii, and III, 1921, pp. 47-58). In this work a number of species which I had figured as new are also described and figured; but since my figures give different views of the same structure they have been retained.

Dicranomyia.

Since some of the species of this genus were inadequately studied or inaccurately described by Verrall, and since moreover there are a number of additions to be made, a fresh table of the British species will not be out of place. The table has purposely been made without reference to the male hypopygium, but it should be noted that in some cases the species which are most alike in other characters are the most easily distinguished when reference is made to this organ.

1. Sc_1 extending considerably beyond the base of Rs . . 2.
   Sc_1 ending nearly opposite base of Rs . . . . 3.
2. Largish species; wing hairy on apical half . *pilipennis* Egg.
   Small species; wing bare; discal cell open . *aquosa* Verr.
3. Sc_2 close to tip of Sc_1 (frons silvery; wings spotted) *dumetorum* Mg.
   Sc_2 far before tip of Sc_1 . . . . . 4.
4. Wings conspicuously spotted . . . . . 5.
   Wings clear, or with stigma only (cross-veins and base and apex of Rs more or less clouded in *D. chorea*) . . 8.
5. Cu_1a about its own length before base of discal cell *ornata* Mg.
   Cu_1a close to base of discal cell . . . . . 6.
6. Veins R_1 and Cu yellow, the rest dark; Cu usually with small dark spots along it . . . . *goritiensis* Mik.
   Veins all dark, at least Cu not noticeably yellow . . 7.
7. Mesonotum shining yellowish, with a black longitudinal stripe; wing-tip conspicuously darkened; no dark spot in middle of Sc . . . . . *lucida* Meij.
   Mesonotum dull brown, unstriped; wing-tip but little darkened; a dark spot in middle of Sc . . *didyma* Mg.
8. Mesonotum not all shining black; frons dull . . . 9.
   Mesonotum, or at least the praescutum and scutum, entirely shining black; frons silvery . . . . . 18.

9. Apical antennal joints elongate, with long bristles (thorax yellowish with three dark stripes) . . . . 10.
Apical antennal joints rounded or shortly oval, with short bristles . . . . . 11.

10. Discal cell open; ovipositor black at the base beneath *patens* Lundst.
Discal cell closed; ovipositor all yellowish beneath . 10a.

10a. Antennae all black . . . . *ventralis* Schum.
Basal joint of antennae yellow . . . *modesta* Mg.

11. Cross-veins clouded (more or less); a dark spot at apex of Rs which extends obviously into the upper basal cell; legs very slender, the femora usually with distinct dark tips; abdominal segments pale posteriorly . . . . *chorea* Mg.
Cross-veins not clouded, or only very indistinctly; apex of Rs without a dark spot, or with a very small one which does not extend into the basal cell; legs usually stouter, the tips of the femora less distinctly darkened; dorsum of abdomen nearly uniform in colour . . . . . 12.

12. Thorax entirely yellow, without distinct grey pollinosity; basal joint of antennae usually yellow . . . *lutea* Mg.
Thorax dark, at least in the middle of the mesonotum, which usually has a distinct grey pollinosity . . . . 13.

13. Black or dark grey species, with greyish pleurae . . 14.
Yellowish species, at least with yellowish pleurae . . 16.

14. Stigma absent or very faint . . . . . 14a.
Stigma distinct . . . . . 15.

14a. Halteres extremely long (about as long as the greatest breadth of the wing), the whole knob and most of the stem dark *halterella* sp. n.
Halteres much shorter, tip of knob only dark . *sericata* Mg.

15. Wings perfectly clear, scarcely longer than the abdomen; stigma squarish, black; central stripe of mesonotum scarcely shining . . . . . *stigmatica* Mg.
Wings slightly brownish tinged; considerably longer than the abdomen; stigma rather longer, brown to brownish-black; mesonotum with shining blackish central stripe *affinis* Schum.

16. Dorsum of abdomen mainly or entirely dark; thorax without distinct stripes; cross-veins and base and apex of Rs often slightly infuscated . . . . . *mitis* Mg.
Abdomen mainly yellow, at most with a blackish longitudinal stripe; three dark stripes on mesonotum; cross-veins and Rs never infuscated . . . . . 17.

17. Antennae all black; stigma usually distinct; ovipositor all yellow . . . . . *autumnalis* Staeg.
    First antennal joint yellow, at least at the base; stigma practically absent; ovipositor black at the base beneath *sera* Walk.
18. Scutellum and postnotum dull grey; abdomen almost entirely yellow; stigma very faint . . . *rufiventris* Strobl.
    Scutellum and postnotum shining black; abdomen mainly black, at least dorsally; stigma distinct . . . . 19.
19. Ventral side of abdomen mainly black, with narrow yellowish rings . . . . . *morio* F.
    Ventral side of abdomen mainly yellow, with narrow black rings . . . . . *pseudomorio* Alex.

D. ornata Mg. Apparently a rare species; there are examples in the British Museum from Cusop, Hereford, taken by Lt.-Col. Yerbury on the undersides of butterburr leaves, while Dr. W. Wallace informs me that he has taken it in the same situations near Grimsby. The species is easily distinguished by the position of the vein Cu_1a (great cross-vein) and by the four large dark spots on the costa, the first and fourth being at the base and apex of the wing. The vein Cu is entirely dark and dark-bordered, not spotted; the species first recorded by Verrall as *D. ornata*, which has this vein spotted, is really *D. goritiensis*.

D. goritiensis Mik. Apparently common along the south coast from the Isle of Wight to Cornwall. I took it abundantly last June on wet cliffs and rocks on the shore at Sidmouth. An interesting aberration from Lelant, Cornwall (*Lt.-Col. Yerbury*) is in the British Musuem. In this specimen (a male) the only dark spot on the wing, apart from the stigma, is a cloud in the upper basal cell beneath the base of Rs. The yellow veins R_1 and Cu and the structure of the hypopygium prove its identity.

D. lucida Meij. I first recognised this very distinct species from a female taken by Mr. A. H. Hamm at Hogley, Oxford, 10 viii. 1915, and presented by him to the British Museum; last June I found it at Weston Valley, near Sidmouth; I believe it was common there, though I only took away one specimen. There are other examples in the late Mr. F. C. Adams' collection in British Museum, collected by Dale, and named *D. ornata*, to which this species bears a considerable resemblance. All these specimens

are alike in their thoracic markings, and differ somewhat from de Meijere's description, but he had no hesitation in regarding as *D. lucida* a specimen which I sent him. There is a male in the Cambridge Museum from St. Merryn, Cornwall (*Lamb*).

D. patens Lundstr. I only know this as British from a female in the British Museum taken at Aviemore, Inverness, 10 viii. 1911 (*Lt.-Col. Yerbury*). This agrees in most details with a female from Finland named by Lundström, and I have very little doubt as to the determination. The open discal cell may possibly not be constant.

D. ventralis Schum. South Uist, Hebrides, 13 vi. 1906 (*B. Kinnear*); Freshfield, Lancs., 29 ix. 1920 (*H. Britten*). The hypopygium (Pl. I. fig. 2) differs slightly from de Meijere's figure, but there can be little doubt of the identification. The reduced palpi are diagnostic.

D. chorea Mg. Verrall and de Meijere both seem to me to have confused two quite distinct species under this name, both of them widespread and abundant. The one which I consider to be the true *D. chorea* is very variable in colour, but can be fairly easily recognised by the characters given in the key. In addition to these it differs slightly but constantly from the allied species in the structure of the hypopygium: the fleshy lower claspers are scarcely longer than broad, and the two spines on the "rostrum" (*i. e.* the inward projection of the fleshy claspers) are short, slightly shorter than the rostrum, just as in de Meijere's figure. A peculiarity of this species, which I have not noticed in its allies, is that the newly-emerged fly frequently has a green body.

D. mitis, Mg. This is the other common species which has been confused with *D. chorea*. The identification with Meigen's *mitis* is due to Goetghebuer and Tonnoir: it will be convenient to follow them and so avoid proposing a new name. Apart from the distinctions given in the key, which are usually, but perhaps not invariably applicable, this species differs from *D. chorea* in the male hypopygium: the fleshy lower claspers are much larger, and at least half as long again as broad, and the two spines on the "rostrum" are about twice as long as the rostrum itself. The hypopygium of *D. affinis* and *D. lutea* has an almost identical structure, and it is quite possible that these species are nothing more than the extreme dark and light forms of *D. mitis;* such at least is the opinion of de Meijere (in

letter). With this author's further opinion (also in letter) that all these three are mere varieties of *D. chorea*, I can, however, by no means agree.

D. affinis Schum. This, as mentioned above, may not be specifically distinct from *D. mitis* and *D. lutea*, but the colour differences are so extreme that I prefer to separate the three forms. *D. affinis* seems to be very common in hilly districts (Scotland and Welsh borders) and also in the New Forest. It is the species recorded as *D. stigmatica* by Verrall, and probably also the *D. stigmatica* of Bergroth. Meijere considers that *D. affinis* is the same as his *D. stigmatica*, but I consider that Schummel's description applies better to the species now under consideration; there appears to be no other name applicable to it.

D. stigmatica Mg. This is really an addition to the British list, which I have seen from Newtonmore, Inverness (*F. Jenkinson*), Perthshire (*A. E. J. Carter*), and Bonawe, Argyll (*J. Waterston*); it is well distinguished from other British species (in the male sex) by the greatly swollen and complicated hypopygium. Some discrepancies in the figures notwithstanding, de Meijere is probably right in regarding the *D. stigmatica* of Osten-Sacken as the same as the species figured by himself, and also *D. nigristigma* Nielsen. Meigen's description is inconclusive, but it will be as well to follow Osten-Sacken and de Meijere in their identification of the species.

D. autumnalis Staeg. This is the *D. mitis* Mg., of the British list; de Meijere, however, figures it as *D. autumnalis* and remarks that though *D. mitis* Mg., is hardly recognisable without an examination of the type, it is probably not the species so determined by Verrall. Probably Verrall himself had doubts on the point, since some of the specimens in his collection stood as *D. autumnalis*.

D. halterella sp. n. (Pl. I. fig. 1.)

A species somewhat resembling *D. sericata*, but smaller, more slender, the mesonotum less distinctly striped, and the halteres of a remarkable shape. *Head* dull dark brown; proboscis lighter; antennae and palpi entirely black; flagellar joints all about equal, oval, with short verticils not longer than a single joint. *Thorax* dark ochreous-brown, dull, pollinose; pleurae greyer; mesonotum with a rather indistinct dark central stripe. *Abdomen* blackish-brown above, pale beneath on the first three segments; hypopygium pale, with a very complicated structure (see fig. 1). *Legs* slender,

dark brown, coxae and bases of femora ochreous. *Wings* hyaline, iridescent; the stigma very faint; veins dark; in shape rather long and narrow, the narrow basal portion somewhat elongate, the anal angle very little prominent. Venation without any noteworthy peculiarity, practically as in *D. sericata*. *Halteres* very long and slender; if extended backwards they would reach to the middle of the third abdominal segment; knob elongate; colour blackish except for base of stem. Length of body, 6 mm.; wing 7 mm.; halteres 1·5 mm.

The British Museum collection contains only the type, a male from Catacol, Arran, Sept. 1920 (*J. Waterston*). A second male, from Kirkmichael, Perth, is in Mr. A. E. J. Carter's collection.

This interesting species shows much resemblance in the structure of its hypopygium to *D. ponojensis* Lundst.; there are, however, a number of small differences, and Lundström does not mention the long halteres. The North American *D. halterata* O.S., would seem to be allied, but can hardly be the same. In the shape of the wings *D. halterella* shows some approach to the tropical genus *Thrypticomyia*, but the halteres are even longer than in that genus, and the antennae are quite different. The North European, *D. danica* Kuntze, is similar in several respects, but has halteres of the normal length.

D. sericata Mg. I find this species abundant on rather dry cultivated land in May and June. Though well distinguished in coloration, its hypopygium is very similar to that of *D. autumnalis*, both species having long hairy ventral processes from the side pieces.

D. sera Walk. This, according to Walker's type, is the species figured by de Meijere as *D. forcipula*. Other synonyms are *globata* Walk., *disjuncta* Walk., and *discors* Kuntze. It differs markedly from all its allies in the structure of the hypopygium, the fleshy lower claspers being long, narrow and bent in the middle; the only other British species bearing even the slightest resemblance to it being *D. morio*. Apart from Walker's types, I have only seen it from Aldeburgh, Suffolk (*Verrall*) and Wareham and Studland, Dorset (*Yerbury*).

D. rufiventris Strobl. This was added to the British list by Mr. A. E. J. Carter (Ent. Mo. Mag. 1913, p. 180). My colleague, the Rev. J. Waterston, took two males at Bonawe, Argyll, August 1919.

D. pseudomorio Alex. This has only very recently (Trans. Amer. Ent. Soc., xlvi, p. 3, March 1920) been described by Alexander from Saitama, Japan. The hypopygium agrees closely with Alexander's description, and is very different from that of *D. morio*, so that I have no doubt, in spite of the wide geographical gap, that the species is correctly determined. The British Museum possesses three males and one female from Loch Assynt, Sutherland, vi. 1911 (*Lt.-Col. Yerbury*).

Rhipidia.

Two subgenera are represented among the British species. *R. maculata* is a true *Rhipidia* (the type of the genus) with the antennae bipectinate in the male and almost simple in the female. *R. ctenophora* Lw., and *R. uniseriata* Schin., belong to Alexander's subgenus *Monorhipidia*, with unipectinate antennae in the male, subpectinate in the female. The last named has not hitherto been recorded as British, but there is a female in Stephens' collection in the British Museum, and three females in the Cambridge Museum from Brockenhurst (*Sharp*). It differs slightly from *R. ctenophora* in the structure of the antennae, and in having no dark spot in the basal third of the wing. The British *Monorhipidia* both have the subcostal vein elongate, as in *Limnobia*.

Limnobia.

L. dilutior sp. n.

Similar to *L. nubeculosa* and *L. flavipes*, and very closely resembling *L. hercegoviniae* Strobl, from all of which it appears to be distinct. *Head* dark grey, the frons lighter. Antennae blackish; first flagellar joint with its basal half conspicuously yellow; second and third also narrowly yellowish at the base. Proboscis and palpi black. *Thorax* much darker than in *L. flavipes;* the pleurae, scutellum and postnotum with a heavy grey dusting. Praescutum with an ill-defined, slightly shining dark brown median stripe; remainder of mesonotum dull. A blackish spot just in front of the wing-base, much smaller than the similar spot in *L. flavipes;* another small spot in the middle of the pleurae, which appears blackish when seen from above. *Abdomen* almost uniformly dark; the first three or four sternites yellowish towards base; hypopygium lighter, in structure practically identical with that of *L. flavipes*. *Legs* darker than in *L. flavipes*, especially the femora, which have *two* darker rings (both rather indistinct, owing to the dark ground-

colour, but of equal intensity) separated by a narrow paler ring. *Wings* resembling those of *L. flavipes*, but with the dark markings much *less* distinct; in particular the spots round the apex of Sc and the base of Rs are smaller; on the other hand, there are in the upper basal cell between the base of the wing and the base of Rs *two* faint clouds instead of only one (these are scarcely perceptible in the Nottinghamshire specimens), and there is another faint cloud over the middle of Rs. The wing is narrower than in *L. flavipes*, and differs somewhat in venation: Rs and R_{2+3} are even more nearly in a straight line than in *L. flavipes*, Rs being longer and straighter than in *L. nubeculosa;* Cu_1a is about one-third of its length before the base of the discal cell; and the discal cell is somewhat longer than in *L. flavipes*, the two veins at its apex both straight and equal in length.

I took a male at Sandy, Beds., 10 v. 1910, and Prof. J. W. Carr has sent me a male and female taken at Woodborough, Notts., 11 ix, 1920, by sweeping broom bushes. The museum also possesses two males from Victoria Park, Manchester (*H. Britten*) and one from Aberlady, 24 v. 1904 (*J. Waterston*, pres. by *A. E. J. Carter*).

Most of the points of difference mentioned above between this species and *L. flavipes* are given by Strobl for *L. hercegoviniae*. I should have considered the species to be the same as Strobl's, had he not stated that (1) the wings are *more* spotted than in *L. flavipes*, almost identical with those of *L. nubeculosa;* and (2) the thorax has three shining blackish-brown stripes with two reddish-yellow triangles between them in front. This species is probably identical with *L. hercegoviniae* as identified by de Meijere (1921).

L. masoni sp. n.

Close to *L. nigropunctata* Schum., agreeing with it in antennae (structure and coloration) and wings (venation and markings), also in the structure of the hypopygium, but differing as follows:—*Thorax* much darker; praescutum entirely shining black, except for a small area on each side just in front of the suture; pleurae and postnotum dark brown. *Abdomen*, including hypopygium, shining black, with small yellowish areas at the base of the third and fourth tergites. Front femora resembling the others in having only a narrow black ring at the tip.

I took a female in Dovedale, Derbyshire, 25 vi. 1911; there is a male in the British Museum from King's Lynn,

vi. 1915 (*Atmore*), and Mr. Collin tells me he also possesses the species. The name is a manuscript one bestowed by Verrall; the type specimen is the male from King's Lynn.

L. decemmaculata Lw. This appears to be widely distributed, though nowhere common. I have seen examples from Nethy Bridge (*Lamb*), Leigh Woods, Bristol (*Hudd*); North Herts. (*F. W. E.*); South Herts. (*Austen*) and Henley-on-Thames (*Scott*). Small specimens have a rather strong resemblance to *Dicranomyia dumetorum* especially on account of the silvery frons, but the venation and other characters will distinguish them.

Helius (*Rhamphidia*).

For conformity with the rules of zoological nomenclature, the name *Helius* (St. Fargeau and Serville, 1828) must replace *Rhamphidia* (Meigen, 1830). Since Riedel has recently revived the alternative name *Megarhina* some explanation is necessary as to why this name is rejected in favour of *Helius*. According to Kertesz's catalogue, both these names were published in 1825 (Encycl. Method. Zool. x, pp. 585 and 831), but, as shown by Sherborn (Ann. Mag. Nat. Hist. (7) xvii, p. 577), the date of the second half of the volume in which they appear was really 1828. In 1827 Robineau-Desvoidy had proposed *Megarhinus* for a genus of Culicidae, and for this (implied) reason St. Fargeau and Serville altered their name *Megarhina* to *Helius* in the index. Although the nomenclature rules allow the retention of two generic names differing only in termination, and I have elsewhere argued in favour of this, it would obviously be very inconvenient to have a *Megarhinus* in Culicidae and a *Megarhina* in Limnobiidae. The name *Megarhina* is therefore rejected; this course can be justified by the fact that both *Megarhina* and *Helius* were published on the same date by the same authors, whose desire was clearly that the latter should be used. *Helius* should not be considered preoccupied by *Helia* (Hübner, 1816, Lepidoptera).

I cannot agree with Verrall and de Meijere that the three described European species of this genus should be lumped together. We certainly seem to have three distinct species in this country, none of which can be satisfactorily identified with the descriptions of either *H. longirostris* or *K. inornatus*, nor yet with the Japanese species recently described by

Alexander. Two of these are therefore described below as new, though it is certain that the first at least occurs on the Continent (compare Riedel's remarks, Entom. Rundschau, xxxvi). All three are alike in venation. The pupae show slight specific differences.

H. pallirostris sp. n. (Pl. I. fig. 5.)

Mesonotum with three distinct dull black stripes on a light brown ground-colour. *Head* greyish-ochreous with a longitudinal black mark; proboscis light brown beneath, darker above. Antennae all black; basal flagellar joints about twice as long as broad; verticils long, as in the other two species. Stigma roundish, nearly black and very distinct. Legs rather dark brown, tips of femora nearly black. *Hypopygium:* ninth tergite with two little rounded hairy projections in the middle. Ninth sternite swollen and somewhat produced in the middle, bare at the sides. Side pieces with a large dorsal, basal membranous projection, serrate on its posterior edge. Upper (or inner) clasper bent before $\frac{1}{3}$, its terminal $\frac{2}{3}$ quite smooth. Lower clasper very short, ending in a single curved spine.

I have taken this species at Letchworth, Herts., and Slapton, S. Devon; in the former case it was reared from larvae found in rotting leaves of *Typha*. It can hardly be *H. longirostris*, which is described as having a blackish-brown proboscis; nor *H. inornata*, which is said to have reddish legs with a dark ring *before* the tips of the femora.

H. dubius sp. n. (Pl. I. fig. 3.)

Thorax, rather dark brown, pleurae more greyish, sometimes with an ochreous tinge; mesonotum slightly shining, with three broad but ill-defined darker brown stripes. *Head* dark grey, unmarked; proboscis black. Stigma rather elongate, light brown. Antennae all black, distinctly shorter than in *H. pallirostris*, the basal joints of the flagellum very little longer than broad. *Legs* dark brown, femora lighter at the base. *Hypopygium:* very similar to that figured by de Meijere for *H. longirostris*, but the claspers of a rather different shape; the upper (inner) pair have a much more pronounced hump at the bend, and the lower (outer) pair are bare and have the pale basal part very much broader, especially just before the middle. (In fig. 3 they are somewhat fore-shortened and do not show the full breadth.)

The British Museum series comprises specimens from Lymington and Tunbridge Wells (*Verrall*) and Radwell, Herts., and Corriegills, Arran (*F. W. E.*); Mr. Cheetham

has it from Gormire and Austwick, Yorks. Mr. K. G. Blair has reared it from larvae found in rotting stems of *Typha* at Hampstead. This cannot very well be *H. longirostris*, which according to the description of Meigen has a pale yellow head and a distinctly striped thorax.

H. flavus Walk. (Pl. I. fig. 4.)

Thorax almost uniformly yellow-ochreous, the mesonotum sometimes with an indistinct dark median stripe in front. *Head* blackish-grey, lighter round the eyes. Proboscis black. Antennae with the second joint reddish; flagellar joints intermediate in length between those of the two previous species. *Legs* rather lighter than in *H. dubius*, the femora without dark rings at the tips. Stigma absent. *Hypopygium:* much like that of *H. longirostris* (Meijere's figure), but the lower claspers with a scarcely perceptible pubescence; the upper claspers with four or five thick spine-like projections at the bend.

Besides Walker's type male, specimens are in the British Museum from Lymington (*Verrall*); Rickmansworth (*Dr. W. Wallace*) and the Hitchin district (*F. W. E.*); Finchley (*K. G. Blair*), reared from larvae found among decaying reeds.

Orimarga.

O. virgo was recorded by Verrall from "a little grassy slope against the river Torrigill at Inchnadamph in Sutherland." In June 1911 Col. Yerbury visited this exact locality, hoping to find the species again, and did in fact capture a single specimen of an *Orimarga*. However, on examination this proved to be not *O. virgo*, but *O. attenuata* Walk. (= *alpina* Zett.), and hence an addition to the British list. It differs from *O. virgo* in the grey thorax, darker legs, and the venation (*r-m* cross-vein beyond instead of before the first fork of the media, etc.). Of *O. virgo* it is worthy of note that there is a male in the British Museum from Seaton Hole, Devon (*Eaton*).

Antocha.

Rondani's name *Taphrophila* cannot apply to this genus, since he says that the marginal cross-vein is absent; hence there is no reason for upsetting Osten-Sacken's name. The European species is now known as *A. vitripennis* Mg., since de Meijere has shown that it is distinct from the American *A. opalizans*.

GONOMYIA.

1. Cu_1a far before the fork of M; discal cell open; R_3 curved upwards at the tip (subgenus *Ptilostena*) . . . 2.
   Cu_1a close to fork of M (either slightly before or beyond it); discal cell usually closed; R_3 almost straight (subgenus *Gonomyia*) . . . . . 4.
2. Wings elaborately spotted . . . *sexguttata* Dale.
   Wings not spotted . . . . . 3.
3. Cross-veins clouded; an extra cross-vein in cell R_3 *jucunda* Lw.
   Cross-veins clear; no extra cross-vein . . *connexa* Lw.
4. Rs very short, its base well beyond the apex of Sc *abbreviata* Lw.
   Rs long, its base well before the apex of Sc . . . 5.
5. R_{2+3} nearly straight, shorter or at most very slightly longer than R_2 . . . . . 6.
   R_{2+3} more or less arched at base, distinctly longer than R_2 7.
6. Body mostly shining black; discal cell open . *lateralis* Meq.
   Body brown, scarcely shining; discal cell closed *alboscutellata* v. Ros.
7. Pleurae usually entirely sulphur-yellow; abdomen above with broad yellow margins; scutellum and posterior part of mesonotum somewhat shining . . . . . 8.
   Pleurae with darker markings; abdomen above with narrow yellow margins; thorax entirely dull . . . . 9.
8. Discal cell at least twice as long as its greatest breadth *recta* Tonn.
   Discal cell less than twice as long as its greatest breadth *lucidula* Meij.
9. Pleural markings very indistinct . . . *tenella* Mg.
   Pleural markings distinct, black . . . . . 10.
10. Proboscis orange-yellow . . . . *dentata* Meij.
    Proboscis dark above . . . . . *simplex* Tonn.

G. sexguttata Dale. Mr. C. G. Lamb has taken this species in numbers at St. Merryn, Cornwall, which is the only recent record I know of.

G. jucunda Lw. I have seen no example of this species, which is regarded as British solely on the strength of Mr. R. C. Bradley's somewhat doubtful record (Ent. Mo. Mag. xxix, p. 285).

G. connexa Lw. Lt.-Col. Yerbury took two females of this species at Porthcawl, Glamorgan, 20 v. 1903 and 3 viii. 1906. These are now in the British Museum.

G. abbreviata Lw. This easily recognised species is represented in the British Museum by two males, one taken many years ago by J. C. Dale; the other I took at Cambridge, 2 vi. 1910. Mr. F. Jenkinson has also taken a female at Cambridge.

G. lateralis Macq., is a common and well-marked species; **G. alboscutellata** v. Ros. (= **G. scutellata** Egg.) on the other hand seems to be rare; I only know it from Herefordshire (*Wood*).

G. recta Tonn. Closely resembles *D. lucidula* Meij., but larger, and usually (perhaps not always) with a longer discal cell. Hypopygium as in Pl. I. fig. 6; note especially the peculiar structure of the aedoeagus. This is probably a fairly common and widespread species. Verrall's specimens were from Freshwater, I. of Wight. I have taken it at Hitchin, Herts., Snailbeach, Salop, and Sidmouth, S. Devon; in June and July.

G. lucidula Meij. Probably common. Bonawe, Argyll (*Waterston*); Ffrith, Flintshire; Snailbeach, Salop; Dartmouth (*F. W. E.*); Gormire and Austwick, Yorks (*Cheetham*).

G. tenella Mg. Probably common. British Museum material is from Herts., Beds., Hunts. and Dorset.

G. dentata Meij. Some British records are: Princetown and Lyndhurst (*Verrall*); Loch Assynt (*Verbury*); Snailbeach, Salop (*F. W. E.*); Corrour, Inverness (*Grimshaw*); New Forest (*Sharp*).

G. simplex Tonn. A somewhat larger species than *G. dentata*, and with a dark proboscis, but otherwise extremely similar. Hypopygium similar to that of *G. dentata*, but differing in details, notably in the curious hook at the tip of the aedoeagus (see Pl. I. fig. 7). All the material examined is from hilly or mountainous districts. Various localities in Arran (*F. W. E.*); Inchnadamph, Sutherland (*Verbury*); Ffrith, Flintshire (*F. W. E.*); Nethy Bridge, Inverness (*Lamb*).

Rhabdomastix.

As has recently been stated by Alexander, the European species *Gonomyia schistacea* and *G. laeta* belong to the subgenus *Sacandaga* of *Rhabdomastix;* they differ from *Gonomyia* in having Cu_1a in the middle of the small discal cell, the branches of M strongly divergent at the base; also in being devoid of yellow coloration.

Empeda.

I prefer to regard *Empeda*, and the other groups allied to *Erioptera*, as distinct genera, as has been done by most European writers, though not by Osten-Sacken and Alexander, the two leading authorities on this group in America. Rondani's *Ilisophila* has been quoted as the same as *Empeda*, and his diagnosis certainly suggests that this may be so, but he gives "*Erioptera lutea* Mg." as the type, therefore his name can hardly be adopted.

Ilisia.

Rondani's name *Ilisia* must take the place of Osten-Sacken's *Acyphona*. We have two British species, the common *I. maculata* with spotted wings, and the rarer *I. areolata* Siebke, with plain wings and very small discal cell. The latter occurs at Glasgow (*Henderson*, Brit. Ass. Handb. Nat. Hist. Glasgow, 1901, p. 268); Rocester, Staffs. (*F. W. E.*); Shotover, Oxford (*Hamm*); Farnley, Leeds (*Cheetham*); Midlothian (*A. E. J. Carter*, Ent. Mo. Mag., 1913).

Erioptera (s. str.).

1. Wing-veins inconspicuously hairy towards apex only; dark species; thorax with a narrow black central line . . 2.
   Wing-veins conspicuously hairy for almost their entire length 3.
2. Larger species; wings broader; discal cell usually closed; wings clear . . . . . *trivialis* Mg.
   Smaller species; wings narrower; discal cell usually open; cross-veins often more or less clouded, sometimes also a cloud below tip of R_1 . . . . . *diuturna* Walk.
3. A distinct brown cloud along apical half of costa; legs pale yellow . . . . . *limbata* Lw.
   Wings unicolorous . . . . . 4.
4. Pale yellow species . . . . . 5.
   Brownish ochreous to blackish-brown species . . . 6.
5. Palpi black; eyes very large, almost touching in the male *macrophthalma* Lw.
   Palpi brown; eyes much smaller, widely separated in both sexes . . . . *flavescens* Mg.; *meijerei* sp.n.
6. Blackish-brown species . . . . *fuscipennis* Mg.
   Ochreous species, at least with ochreous pleurae . . 7.
7. Knob of haltere blackish, stem very pale; mesonotum darkened in the middle . . . *taenionota* Mg.; *minor* Meij.
   Knob of halteres scarcely darker than the stem, which is less pale; mesonotum not darkened in middle . . . 8.

8. Large species; uniformly ochreous-brown, including the wings; legs stout . . . . . *squalida* Lw.
   Smaller species; wings lighter; legs more slender . . 9.
9. Terminal flagellar joints elongate, especially in male, with long verticils . . . . . *nielseni* Meij.
   All flagellar joints alike, oval, verticils shorter . . . 10.
10. Abdomen concolorous with thorax . . . *verralli* sp. n.
    Abdomen more or less darkened, except for the tip *griseipennis* Mg.

E. trivialis Mg. In this species the radial cross-vein is sometimes placed slightly before the fork of R_2 and R_3; such specimens might be mistaken for a *Cheilotrichia*, but the species is a true *Erioptera* with a long sinuous axillary vein.

E. diuturna Walk. The wings are narrower and the hair on the veins at the apex of the wings is even less noticeable than in *E. trivialis*, and there are a number of slight differences in the hypopygium: the upper (inner) clasper is broader, and has several long hairs on its lower apical margin which are absent in *E. trivialis;* the lower (outer) clasper is narrowed rather suddenly on its apical third instead of slightly and gradually from the base, this apical third only being black; there is no little projecting lobe at the base of the ventral side of the side pieces, and the aedoeagus is differently constructed. Walker's *diuturnus* included two species; I propose to fix his name for this one as there seems to be no other name available. The wing-markings of the darkest specimens are very suggestive of *Symplectomorpha stictica.*

Localities: Yarmouth, I. of W. and Winfrith, Dorset (*Cockerell*); Austwick, Yorks (*Cheetham*); Catacol, Arran (*Waterston*).

E. limbata Lw. There is a pair of this very distinct species in the British Museum, presented by J. C. Dale in 1864, and taken by him in Dorset. Another pair, also from Dale, is in Mr. Collin's collection, named by Verrall *E. lutea.*

E. macrophthalma Lw. This is probably fairly common and widely distributed. I have taken it at Hitchin (Herts.) and Snailbeach (Salop).

E. meijerei sp. n. (Pl. I. fig. 8).

Very similar to *E. flavescens*, differing only in the hypopygium (see fig. 8), which is more like, though not identical with, that of

E. macrophthalma. Side pieces simple, without the hairy apical lobe of *E. macrophthalma*. Upper clasper with a strong sharp black point, apically directed, just beyond the middle. Lower clasper long, strap like, black at the tip. *Parameres* very strong and thick, black.

I know this species only from a single male from Wicken, 17 vii. 1885 (*Verrall*). Prof. de Meijere informs me he has taken three males, all at the same locality in Holland. I therefore have pleasure in dedicating the species to him, in recognition of his invaluable work on European Limnobiidae.

E. taenionota Mg. I cannot follow de Meijere in using the name *E. lutea* Mg. for this species. *E. lutea* was described as having the abdomen entirely yellow, which is certainly not true of *E. taenionota*. No British species agrees accurately with Meigen's description of *E. lutea*, and this name should therefore be dropped from our list.

E. verralli sp. n. (Pl. I. fig. 9).

Whole body, including abdomen, legs, wing-veins and halteres, dull brownish-ochreous; palpi, vertex and flagellum of antennae darker; pronotal lobes yellowish. Joints of antennal flagellum all oval and approximately equal in size; verticils not very long. Wing-membrane transparent; hair on veins moderately long. Stem of cell R_2 rather shorter than that of cell M_3. Cu_1a straight, slightly oblique, reaching M just before the fork. *Hypopygium* (see fig. 9): side-pieces simple, nearly cylindrical, about three times as long as broad. Upper (inner) clasper pale throughout, simple, somewhat tapering a little beyond the enlarged base; tip rounded, with two apically directed hairs. Lower clasper darkened apically, enlarged and divided at tip (see figure). *Parameres* rather slender, each ending in two long sharp points, which are somewhat darkened.

A male and female from Dovedale, 14 vi. 1888 (*Verrall*) are in the British Museum.

E. griseipennis (Mg.) Meij. Probably a fairly common species. The British Museum has specimens from Frant, Sussex and Dullingham, Cambs. (*Verrall*) and Letchworth and Radwell, Herts. (*F.W.E.*). I have also seen specimens from Nottingham (*Carr*) and Cambridge (*Jenkinson*).

E. minor Meij. Major E. E. Austen took a pair of this species at Harrow, 4 vii. 1894. Its describer distinguishes it from *E. taenionota* by the colour of the thorax and the

venation, but our specimens do not differ from *E. taenionota* in any noticeable manner, apart from the structure of the hypopygium. Most of the species of this genus vary in the smaller details of the venation, and it seems unsafe to base any specific distinctions on these characters.

E. squalida Lw. This species is common at Norton Pond, Letchworth—a locality which has yielded quite a number of good things. It is of the size and build of *E. flavescens*, but of a brownish-ochreous colour, even on the wing-membrane. Mr. Cheetham has taken it at Gormire, Yorks.

E. nielseni Meij. (1921) (Pl. I. fig. 10).

Head, thorax, hypopygium and legs ochreous brown; palpi blackish; abdomen dingy greyish-ochreous; wings with the membrane clear, hairs light brown, moderately long; halteres uniformly dark brownish. Antennae of the male with the second scapal joint much swollen; first two flagellar joints almost globular; next three somewhat smaller and more elongate; remainder long and slender, with verticils about twice as long as each joint; in the female the second scapal joint is less swollen, and the terminal flagellar joints less elongate. Stem of cell R_2 considerably shorter than that of cell M_3. *Hypopygium* (see fig. 10): side pieces simple, about three times as long as broad. Upper (inner) clasper scarcely darkened apically, with a hump some way before the rounded tip. Lower (outer) clasper somewhat swollen a little before the pointed black tip. *Parameres* short, simple, pointed, black-tipped.

Several males and one female from Austwick, nr. Ingleboro, 17 vii. and 27 viii. 1920 (*C. A. Cheetham*). The antennae resemble those of the *flavescens* group, but the body colour is not such a clear yellow.

Molophilus.

The species of this genus are often very similar, but can be readily recognised by the striking differences in the male hypopygium; in many cases these characters cannot be seen well in the dry specimen; the end of the abdomen must be removed, cleared in potash and mounted. The following key will show which species are distinguishable by other characters. Too much reliance should not be placed on the colour-differences indicated.

1. Blackish species . . . . . 2.
   Yellow or light brown species (at least the thorax) . . 5.
2. Thorax shining black . . . . . 3.
   Thorax dull blackish or dark brown . . . . 4.
3. Wings short and functionless in both sexes . . *ater* Mg.
   Wings normal . . . . . *bihamatus* Meij.
4. Whole body densely clothed with long hair, also the wing-membrane, thorax dark brown, somewhat shining *murinus* Mg.
   Body short-haired (normal); wing-membrane bare, thorax dull blackish-brown . . . . . *obscurus* Mg.
5. Very small species; cross-vein *r* less than twice its own length from the base of R_2; Ax ending before fork of Cu; wing-fringe on basal half of lower margin longer than the breadth of the cubital and two anal cells; legs pale . *pusillus* sp. n.
   Larger; cross-vein *r* generally 3 times its own length from the base of R_2, often more; Ax ending beyond fork of Cu; wing-fringe shorter; legs darkened except towards base of femora 6.
6. Thorax brown; head black or grey; wing-hair dark . . . *bifilatus* Verr.; *curvatus* Tonn.; *occultus* Meij.; *gladius* Meij.; *bifidus* Goet.
   Thorax yellow (sometimes slightly brownish-tinged) . . 7.
7. Wing-hair yellow or pale, at least in large part; head and abdomen yellow . . . . . *appendiculatus* Staeg.; *armatus* Meij.; *medius* Meij. Wing hair all dark . . . . . 8.
8. Head pale . . . . . *pleuralis* Meij.
   Head dark grey on vertex . . . . . 9.
9. Abdomen orange-yellow . *ochraceus* Mg.; *flavus* Goet.
   Abdomen more or less darkened *propinquus* Egg.; *cinereifrons* Meij.

M. pusillus sp. n.

A very small species, allied to *M. murinus* Mg., in venation, but much less hairy, and of a brownish-yellow coloration; halteres pale.

Head, including palpi and antennae, blackish. Joints of flagellum sub-cylindrical, narrowed a little at each end, twice as long as broad, apical joints gradually becoming smaller; verticils nearly three times as long as each joint. *Thorax* uniformly dingy ochreous or brownish-yellow, slightly shining; praescutum with two rows of long brown hairs; a few similar hairs on the scutum. *Abdomen* (except for the last segment and the ovipositor) somewhat darker than the thorax, with shorter but denser hair. *Legs* rather pale ochreous, only the tarsi somewhat darker; hairs of femora about twice as long as the diameter of the legs. *Wings* with long dense

rather dark-brown hair on the veins; the fringe very long, in the middle of the hind margin nearly half as long as the breadth of the wing, or slightly longer than the distance from vein Cu to the wing margin. Radial cross-vein thick, scarcely twice its own length distant from the base of R_2. Basal section of R_{1+5} vertical, practically in one straight line with *r-m*, and about the same length. Cu_1a reaching M before the fork (two specimens) or just beyond it (one specimen). Ax rather short and nearly straight, ending slightly but distinctly before the fork of Cu. *Halteres* ochreous. Length of body 2·5 mm.; wing 3·5 mm.

This species, in venation, seems to connect the rather isolated *M. murinus* with the yellow group of species, but shows no trace of hairs on the wing-membrane. The peculiarities of venation, taken together, are probably sufficient to distinguish it from these latter species, though the venation is evidently subject to some variation. I took three females at Dreghorn, Ayrshire, 22 v. 1919.

M. bihamatus Meij. I have seen only one British example of this species, a female in the British Museum from the New Forest (*F. C. Adams*).

M. curvatus Tonn. I had intended to adopt Curtis' name *crassipes* for this species, but since Tonnoir has proposed a new name for it, it will be better to use the one that is certain. I have taken it in Arran and at Llangollen; it is also represented in the British Museum from the New Forest (*Adams*). Hypopygium, Pl. I. fig. 13.

M. occultus Meij. Brockenhurst (*Verrall*); Gidleigh, S. Devon (*F.W.E.*); Rannoch (*Grimshaw*).

M. gladius Meij. A single male from Oxton Bogs, Notts., 11 v. 1918 (*Carr*), presented by the collector to the British Museum; two more from Austwick, Yorks, 7 vi. 20 (*Cheetham*).

M. bifidus Goet. Superficially identical with the above three species, but with a very different hypopygium. The ventral (morphologically dorsal) plate of the aedoeagus is long, curved, and black, ending in a sharp point, and having at its base a pair of little black teeth (Pl. I. fig. 11*b*). The lower clasper also has a slightly bifid tip. Probably common: Hitchin, Radwell and King's Walden, Herts.; Snailbeach, Salop (*F.W.E.*); Humberton Marshes, Grimsby (*Dr. W. Wallace*); Austwick, Yorks (*Cheetham*).

M. appendiculatus Staej., **M. armatus** Meij., and **M. medius** Meij., are all common and are often found together.

M. pleuralis Meij., is evidently the species Verrall recorded as *M. ochraceus*, though he also had it under a manuscript name. Localities are Slapton and Dawlish (S. Devon), Wicken, and Arran.

M. ochraceus Mg., in the sense of de Meijere, seems to be a rare species with us. I have only seen one male (Bonawe, *Waterston*).

M. flavus Goet. (Pl. 1. fig. 12).

Similar to *M. ochraceus*. *Thorax* and *abdomen* entirely orange. *Legs* blacker than in most other species of the group; femora orange at the base, somewhat swollen on the apical third. *Hypopygium* as in fig. 12; the upper clasper has a waved appearance when seen in side view.

Localities: Corriegills, Arran (*F.W.E.*); Catacol, Arran (*Waterston*); Snailbeach, Salop (*F.W.E.*); Pateley, nr. Leeds (*Cheetham*).

M. propinquus Egg., and **M. cinereifrons** Meij., are both common species, indistinguishable apart from the hypopygium, and frequently, though not invariably, found together.

Rhypholophus.

The two groups of which this genus is composed in Europe and North America seem to me to be of at least subgeneric if not generic value. The genus has sometimes been divided on the presence or absence of a discal cell, and the mode of forking of the media; but a much better division is the one proposed by Verrall, based on the length of the axillary vein. If we regard the length and curvature of the axillary vein as a character of generic importance in *Erioptera*, it seems inevitable to take the same view of the parallel and equally constant condition in *Rhypholophus*. This name will then be restricted to those species with a long and sinuous axillary vein, of which we have only two in Britain, *R. haemorrhoidalis* and *R. varius*. Rondani's name, *Ormosia*, is available for the other group, in which the axillary vein is short and divergent from the anal.

Ormosia.

In this genus *O. fascipennis* Zett. (*pentagonalis* Lw.) is distinguished from the other British species by the possession of a closed discal cell; *O. pseudosimilis* Lundst., and *O. similis* Staeg., by their yellow colour; *O. lineata*

(Mg.) by the dark line down the middle of the thorax; and *O. uncinata* (Meij.) by the whitish pubescence on the hind metatarsus, contrasting with the dark tibia, which is very noticeable in life. The remaining three species are only distinguishable with certainty by the male hypopygium, but the differences in this organ are very striking.

O. uncinata (Meij.). This is a common and widespread species, probably the one which Verrall regarded as *O. nodulosa*. The character of the hind metatarsus seems to be diagnostic (but compare the two new species); it was not mentioned by Macquart, and therefore de Meijere may be justified in restricting Macquart's name to the next species, though *O. uncinata* is the species which has the male antennae most distinctly nodose.

O. nodulosa (Mcq.) Meij. This is the other common species noted by Verrall and Carter as occurring in this country.

O. hederae (Curt.) Meij. Curtis' description and figures would apply about equally well to *O. nodulosa*, but de Meijere's selection will fix this name definitely. All the specimens I have seen are from Scotland: Nairn and Loch Assynt (*Yerbury*); Kinlochewe, Ross (*Grant*); Arran (*F.W.E.*).

O. albitibia sp. n. (Pl. II. fig. 15).

With the characters of *O. nodulosa* (Mcq.), but the male antennae a little longer, the joints slightly more swollen in the middle, the verticils somewhat longer; mesonotum ochreous-tinged at the sides in front; hind tibiae and tarsi (in the one perfect specimen) with the pubescence almost entirely pale, but that on the metatarsus not strikingly paler than that on the tip of the tibia. *Hypopygium* very similar to that of *O. nodulosa* (as figured by de Meijere), but the long yellow hair on the ninth tergite (sternite of de Meijere) is in a larger and broader patch; the bifid tenth tergite (or terminal portion of the ninth) is shorter, and the upper claspers (fig. 15) are very long, curved backwards (caudally) and end in long sharp points.

Two males are before me, one (damaged) from Braemar, 27 vii. 76 (*Verrall*), and one (the type) from Church Stretton, Salop, 24 vi. 1920 (*F.W.E.*).

O. aciculata sp. n. (Pl. II. fig. 14).

Closely resembles *O. uncinata* Meij.; perhaps distinguishable by the colour of the pubescence on the hind leg, that on the hind tarsi being almost entirely whitish, not whitish on the metatarsus only;

the hind tibia has dark pubescence except at the extreme base. Hind femora slender (somewhat clubbed apically in *O. uncinata*). *Hypopygium* (fig. 14) very distinct: the tenth tergite (or apical portion of the ninth) is elongate (as in *O. nodulosa*) and in the specimens examined bent at right angles to the ninth; both pairs of claspers are horny, curved and sharp pointed, and there are also three horny sharp-pointed black processes on the aedeagus.

Stonesdale, Yorks, 22 v. 1920 (*C. A. Cheetham*); 2 ♂, type presented by the collector to the British Museum.

O. similis Staeg. Mr. F. Jenkinson has taken several examples of this species at Logie, Elgin, viii. 1903 and ix. 1913. It seems to be somewhat larger than *O. pseudosimilis*, but apart from this and the difference in hypopygia there is little to distinguish the two. Lundström's figure is not quite accurate; the terminal portion of the ninth tergite (morphologically the tenth) is really deeply divided in the middle as it is in *O. nodulosa*.

O. pseudosimilis Lundst. A male in the British Museum named by Verrall *R. similis*, and taken by him at Inveran, is really *O. pseudosimilis*. A second male from the Clifton collection in the British Museum was probably taken near London; another from Crag Wood, Yorks, is in Mr. Cheetham's collection.

Helobia.

This old name is now generally and correctly used in place of *Symplecta*. *H. hybrida* Mg. (the earlier and therefore correct name for *Symplecta punctipennis*) seems to be a rare insect in Britain. The British Museum possesses a male from the Scilly Is. (collector unknown) and one female from Felden, Herts. (*Piffard*). There is a specimen from Cambridge (*Jenkinson*) in the Cambridge Museum; and I have recently found it in numbers at Shelford, Cambs.

Symplectomorpha.

I consider that Kuntze and de Meijere are justified in reviving this name for *Symplecta stictica* and *S. similis*, and I further agree with de Meijere that these two are not specifically distinct.

Trimicra.

Kuntze in his paper on Palaearctic Eriopterinae attempts to distinguish three species of this genus: *pilipes* F.,

hirsutipes Macq., and *andalusiaca* Strobl. I do not consider, however, that these are really distinct. I have seen British specimens which correspond fairly well to the three forms defined by Kuntze, and they all have identical male hypopygia, while the differences between them in other characters do not seem to be sharply marked, but are bridged by continuous variation. In general the small specimens seem to have less distinctly clubbed femora, somewhat shorter hair on the male tibiae, and less conspicuous dark borders to the cross-veins.

T. pilipes probably has a wider distribution than any other crane-fly. An examination of the hypopygia of a number of specimens in the British Museum shows that it occurs in Uruguay, Ecuador, Argentina, the Falkland Islands, South and East Africa, Victoria, Queensland, the Sandwich Islands, Madeira and Palestine; it is also known to occur in North Africa, the Canaries and North America, as well as throughout Europe. It may be doubted whether the genus really contains more than one cosmopolitan species; from an examination of types or other specimens I can say definitely that *haligena* Woll., *hirtipes* Walk., *inconspicua* Lw., *lateralis* Grim., and *reciproca* Walk., are all synonymous with *pilipes* F. It is not easy to account for the widespread occurrence. The larvae are said simply to live in "moist earth," hence there seems no special reason why the species should be spread by commerce.

Gnophomyia.

A specimen of *G. tripudians* has been taken at Cambridge by Mr. F. Jenkinson. Other species of this genus may be expected to occur in Britain.

Crypteria.

The most important distinguishing character of this genus is the fusion of the three or four basal segments of the antennal flagellum into a single large conical segment. A similar fusion takes place in the genera *Cladura*, *Pterochionea* and *Chionea*, all extra-British genera which differ from *Crypteria* in having only a single clasper, instead of two, on the side-piece of the male hypopygium.

C. limnophiloides Bergr. Since this was recorded (Proc. Ent. Soc. London, 1919, p. xlix), a male has turned up among the accessions in the British Museum from Middle Park, Pool, Glamorgan, 15 x. 1895 (Dr. J. H. Wood).

C. carteri, Tonn.* (Pl. II. fig. 16).

Closely allied to *C. bergrothi*, Kuntze, differing almost solely in the hypopygium (see fig. 16): the side pieces are more slender than in Kuntze's figure, the outer clasper hooked at the tip (straight in *bergrothi*), the inner clasper moderately stout and straight (slender and recurved in *bergrothi*). The venation is somewhat variable, particularly in regard to the position of Sc_2 (at or well before tip of Sc_1) and Cu_1a (near base or almost in middle of discal cell). In some specimens the middle and hind tibiae show a single minute spur at the tip, which is apparently absent in others. Some specimens show 10, others 11 joints in the antennal flagellum beyond the fusion-joint. *C. bergrothi* and *C. carteri* both differ from *C. limnophiloides* as follows:—Marginal cross-vein present though usually very faint; R_2 not much longer than R_{2+3}, or even slightly shorter; Ax shorter and straighter; side pieces of hypopygium with a peculiar long stout spine (evidently a modified bristle) at the base.

Polton, Midlothian, 25 v. 1915 (*A. E. J. Carter*), one male and one female presented by the collector to the British Museum; Ffrith, Flintshire, 7–9 vi. 1919 (*F. W. E.*), 2 ♀; Snailbeach, Salop, 22–28 vii. 1920 (*F. W. E.*) 1 ♀; Victoria Park, Manchester, 22 viii. 1920 (*H. Britten*), 1 ♂.

Idioptera.

I do not consider the differences between *Idioptera* and *Ephelia* to be of generic value, and propose to combine the groups; if the latter is regarded as distinct, it must take Rondani's name *Elacophila*, which is older than *Ephelia*. *Idioptera* as a whole differs from the other genera of the *Limnophila* group in possessing an extra cross-vein in the lower basal cell, but the distinction is not by any means a fundamental one. The cross-vein is occasionally absent on one or both wings in *I. pulchella* and *I. marmorata*. The following table will separate the British species (omitting *I. decora* Hal., which is doubtfully synonymous with *I. marmorata* Mg., and *I. submarmorata* Verr., which I cannot distinguish from *I. marmorata*):—

1. Wings with complete or nearly complete transverse bands; costal cell uniformly brown, darker than most of the wing; male abdomen mostly orange . . . . . 2.
   Wings without complete transverse bands; costal cell either

* This appears to be identical with the North American *Limnophila ultima* O.-S., which Alexander has recently made the type of *Neolimnophila*, a new subgenus of *Limnophila*.

entirely pale, or pale with blackish markings; male abdomen entirely blackish . . . . . 3.

2. Femora and tibiae yellow with black tips; wings of female normal . . . . . *fasciata* L.

Legs black, except base of femora; wings of female rudimentary . . . . . *pulchella* Mg.

3. Wings without dark markings, except over the cross-veins and at the base of Rs; male antennae longer than the thorax. *trimaculata* Zett.

Wings with at least a few additional dark spots, including one near tip of Ax; male antennae shorter than the thorax . 4.

4. Femora gradually darkened from base to tip; the dark spot at the tip of the costal cell almost equidistant from the one over the base of Rs and the one at the tip of R_1; dark spot over humeral cross-vein minute . . . *dalei* sp. n.

Femora yellow with blackish tips; the dark spot at the tip of the costal cell much nearer the one at the tip of R_1 than to the one over the base of Rs; humeral spot generally quite large . 5.

5. Wing-veins entirely without small dark dots, except at their tips . . . . . 6.

Wing-veins with at least a few dark dots along them, in addition to the larger dark markings . . . . . 7.

6. Wing-tip mostly dark, but basal half of R_{1+5} mostly pale. *apicata* Lw.

Wing-tip mostly pale, but R_{4+5} uniformly dark-margined. *mundata* Lw.

7. Wing-veins with only a very few dark dots. *marmorata* var. *verralli* Bergr.

Wing-veins with numerous dark dots . . *marmorata* Mg.

I. fasciata L. There is a single specimen of this species, correctly named, in Stephens' collection in the British Museum. Mr. C. A. Cheetham has taken it at Austwick, near Ingleboro, which is the only recent record I know of.

I. trimaculata Zett. This species forms the connecting link between *I. fasciata* and *I. marmorata*, since although the male antennae are somewhat elongate and constructed as in *I. fasciata*, the outer clasper of the male hypopygium is flattened, black, and finely serrate on the outer edge as in the *marmorata* group. *I. trimaculata* is probably not uncommon in mountain districts; it was abundant at Taw Head, Dartmoor, in June 1920.

I. dalei sp. n. (*vide* de Meijere, 1921) (Pl. II. fig. 17).

Head dark grey, with a small black spot between the eyes. Antennae entirely dark, alike in the two sexes, shorter than the thorax,

basal joints of flagellum almost globular. *Thorax* almost uniformly dark greyish, the praescutum with two rather indistinct dark brown lines. *Abdomen* uniformly dark. Male hypopygium similar to that of *I. apicata*, but different in detail. Ninth tergite somewhat emarginate in the middle; side pieces without a trace of small teeth at the base; claspers (fig. 17*a*) much as in *I. apicata* (fig. 18*a*) but the black outer pair have a longer and sharper median tooth on the outer margin, and the outer half of the outer margin is more distinctly serrate; inner claspers short, almost oval; penis (fig. 17*b*) more than half as long as the side pieces (as in *I. apicata*, fig. 18*b*) but the basal plate is more elongate and pointed in the middle. *Legs* darker than in the allied species; femora pale at the base, gradually darkening towards the tips, which are almost black. *Wings* with a slightly smoky ground-colour, the base not conspicuously yellow. A small dark dot over the humeral cross-vein, and another over the cross-vein connecting Cu with An at the base. Five rather small dark spots along the costa, none of them extending much beyond R_1, and all of them approximately equidistant: the first halfway between the humeral cross-vein and the base of Rs; the second over the base of Rs; the third over the apex of Sc; the fourth and largest over *r-m* and the apex of R_1; the fifth over the apex of R_2. Small dark clouds at the tips of all the veins except R_{1-5}; a small dark spot before the tip of Ax; two or three along Rs; veins otherwise without dots, but all the cross-veins and R_{1+5} dark margined. The wings are rather narrow, alike in the two sexes; additional cross-vein below one-third of Rs; Cu_1a at one-third of discal cell; Sc ending slightly before the radial fork. *Halteres* pale yellow, with blackish knob.

Length of body 5–7 mm.; wing $7 \times 2 - 8 \times 2{\cdot}3$ mm.

Two specimens (♂♀) in the British Museum collected by J. C. Dale, without stated locality, but probably from Dorset; the female bearing the date 29 v. 1861.

I. mundata Lw. This is the species which has been recorded by Verrall as *miliaria* Egger. The agreement with Loew's description is perfect, but I agree with Loew that without the examination of Egger's type the significance of his name is too doubtful to allow of its use in place of the well-distinguished *mundata*. The available evidence suggests that the two are not the same. Claspers, Pl. II. fig. 19.

I. marmorata Mg. This species is extremely variable in wing-markings, but it can always be recognised by the unusual breadth of the male wing, the hind margin coming almost to a point just before the tip of vein Ax; this vein

also has nearly always (in the male only) a very distinct spur a little before the tip on the lower side, which is at most faintly indicated in the other species. A collection made at Brodick, Arran, shows almost the complete range of wing-markings, some being of the typical *marmorata* type, others like *submarmorata* and *verralli;* one has the markings identical with those of *mundata* except for the absence of a dark border to vein R_{4+5}; one exceptionally pale specimen has no markings except for the stigma, the clouded cross-veins, and a small spot near tip of Ax. All these have identical hypopygia; the claspers are shown in Pl. II. fig. 20.

Limnophila.

This genus has recently undergone some further subdivision. Alexander has revived the genus *Pilaria*, to which belong *L. discicollis* Mg., *L. fuscipennis* Mg., and *L. subtincta* Zett.; and has proposed the name *Pseudolimnophila* for the group which includes *L. lucorum* Mg., and *L. sepium* Verr. Both these innovations seem to be quite justified, and it is not unlikely that some further division may be made in the future; *L. ochracea* Mg., can hardly be left permanently in *Limnophila*. Of the two genera above mentioned, *Pilaria* is distinguished by peculiarities of venation and genital tube, and by the habits and morphology of the early stages; *Pseudolimnophila* chiefly by the shape of the head, the back part of which is narrowed and produced into a sort of neck, a character which it shares with *Poecilostola;* possibly *Poecilostola* and *Pseudolimnophila* may eventually be merged, but so far as the British species are concerned there are striking differences in the hypopygium and wings.*

L. abdominalis Staeg. Males of this species have occurred at Aberfoyle, Perth, 28 viii. 1906 (*Carter*), and Austwick, near Ingleborough, 5 vi. 1920 (*Cheetham*). The black thorax and black bands on the orange abdomen will distinguish it at once from *L. bicolor* and *L. punctum*.

L. robusta Wahlgren. There is a female of this species in the British Museum from Studland, Dorset, 1 ix. 1906 (*Yerbury*), and I have seen another from Blairgowrie, Perth, vi. 1913 (*Carter*). It is remarkable for its unusually

* In this connection it is worth mentioning that specimens of *P. punctata* are sometimes to be found without any trace of wing-markings.

short and stout legs, and broad abdomen. Although there is no trace of orange colour on the abdomen, I strongly suspect that it is nothing but the female of *L. abdominalis*: the differences, however, are so considerable that this assumption cannot be made without proof. It is perhaps significant that *L. abdominalis* is known only from the male, *L. robusta* only from the female.

L. leucophaea (Mg.) Meij. A small species somewhat resembling *L. nemoralis*, but with Sc_2 at the extreme tip of Sc_1. Oxton Bogs and Beauvale Woods, Notts. (*Carr*); Crag Wood, Yorks (*Cheetham*).

L. nemoralis Mg. As already mentioned by Verrall, this species is exceedingly variable; the variations are so well marked that I should have no hesitation in regarding them as distinct species, if the hypopygium were not identical in all. The following five forms may be distinguished :—

(*a*) Typical form. Thorax bluish-grey; abdomen somewhat ochreous; antennae generally yellow at the base; stigma rather faint and ill defined, two-thirds of it situate beyond the radial cross-vein; cross-veins quite clear; discal cell nearly twice as long as broad; basal section of M_3 (*i. e.* the upper of the two veins closing the discal cell) curved; cell M_1 not quite half as long as its petiole; Cu_1a at about two-fifths of discal cell. Body length 6–7·5 mm.

This seems to be the commonest form in the South of England.

(*b*) var. nov. *minuscula*. Thorax rather light grey, bluish tinge less distinct; antennae more or less pale at the base; stigma indistinguishable; cross-veins quite clear; discal cell nearly or quite twice as long as broad; basal section of M_3 quite straight, and of the same length as the cross-vein *m*; cell M_1 not a third as long as its petiole; Cu_1a at about one-third of discal cell. Body length 4–5 mm.

I have taken this at Bushy Heath and Knebworth, Herts.

(*c*) Var. nov. *collina*. Thorax dark brownish-grey; abdomen blackish; antennae generally all black; stigma rather faint, equally bisected by the radial cross-vein; cross-veins quite clear; venation and size as in the typical form.

Apparently the commonest form in Scotland; I have also taken it in North Wales.

(*d*) Var. nov. *quadrata*. Like var. *collina*, but the discal cell is very little longer than broad, and Cu_1a is situated exactly at its base.

Also a Scotch form. Arran (*F. W. E.*); Bonawe, Argyll (*J. Waterston*); Cromarty Point (*W. R. O. Grant*): in each case in company with the var. *collina*.

(*e*) Var. nov. *noscibilis*. Thorax dark brownish-grey; abdomen blackish; antennae generally pale at the base; stigma conspicuous and well defined, equally bisected by the radial cross-vein; cross-veins and base of Rs distinctly darkened; discal cell quite twice as long as broad; basal section of M_3 curved; cell M_1 as long as its petiole; Cu_1a at from one-fourth to one-half of discal cell. Body length 7–9 mm.

Widely distributed; the British Museum has specimens from Norfolk, Hants., Devon, N. Wales and Arran.

Hexatoma (*Anisomera*).

I can only recognise two species of this genus in Britain: *H. fuscipennis* (Curt.) (= *Peronecera fuscipennis* Curt., = *Anisomera burmeisteri* of the British list, and perhaps of Loew) with the antennae short in both sexes, and *H. lucidipennis* (Curt.), with long antennae in the male. I think the latter will probably prove specifically identical with *nigra* Latr., *bicolor* Mg., and *aequalis* Lw.; if so, Latreille's name will have to replace Curtis'. The European species of this genus, however, require further study before their limits can be properly understood.

Dicranota and Rhaphidolabis.

The British species may be distinguished thus:—

1. Radial cross-vein absent; only R_2 connecting R_1 and R_3 (genus *Rhaphidolabis*) (otherwise resembling *D. subtilis*) *exclusa* Walk. (= *coelebs* Zett.).
   Radial cross-vein present, hence two veins connecting R_1 and R_3 (genus *Dicranota*) . . . . . 2.
2. Stigma faint or absent; antennae alike in the two sexes . 3.
   Stigma conspicuous; male antennae more or less elongate . 4.
3. M_1 simple; first flagellar joint rather long . *pavida* Hal.
   M_1 forked; first flagellar joint nearly globular . *subtilis* Lw.
4. A distinct dark spot over *r–m*; M_1 usually simple; male abdomen largely reddish . . . . *guerini* Zett.
   No dark spot over *r–m*, though the vein itself is darkened; M_1 always forked; male abdomen dark . *bimaculata* Schum.

D. subtilis Lw., is in the British Museum from Inchnadamph and Bettws-y-Coed (*Verrall*), and I have also seen it from Yorkshire (*Cheetham*).

D. guerini Zett. As recently shown by Lundström, this species is quite distinct from the common *D. bimaculata*, differing in the hypopygium as well as in other characters. Its inclusion now in the British list is due to Mr. C. A. Cheetham, who has taken several at Austwick, near Ingleboro.

TRICYPHONA (*Amalopis*).

1. Rs more or less clouded at the base, and often angulated or spurred . . . . . 2.
   Wings quite clear; Rs never angulated or spurred . . 4.
2. Thorax dark grey, with four blackish stripes; a distinct brown band over the cross-veins . . . . *occulta* Mg.
   Thorax uniformly yellow or orange . . . . . 3.
3. Larger, browner species; femora and tibiae without distinct black tips . . . . . *littoralis* Mg.
   Smaller, yellow species; femora and tibiae with black tips *straminea* Mg.
4. Medium-sized species; pleurae and coxae ochreous . . 5.
   Small species; pleurae and coxae black . . . . 6.
5. Pubescence on veins in apical part of wing fairly distinct; R_{2+3} fully twice as long as R_3* . . . *lucidipennis* sp.n.
   Pubescence on wing-veins barely perceptible; R_{2+3} less than twice as long as R_3 . . . . *claripennis* Verr.
6 * R_{4+5} much shorter than *r–m*; thorax with four distinct narrow shining black stripes . . . . *schummeli* sp. n.
   R_{4+5} longer than *r–m*; thorax otherwise . . . 7.
7. Femora not conspicuously yellow at the base; discal cell often present; middle thoracic stripe divided by a pale line . . . . . *unicolor* Schum.
   Femora conspicuously yellow at the base; discal cell never present; middle thoracic stripe entire, or obscurely divided by a dark line . . . . . *immaculata* Mg.

T. lucidipennis, sp. n. (Pl. II. fig. 24).

Closely allied to *T. claripennis* Verr., and almost identical with it in size and coloration, but differing as follows: *Wings* somewhat broader (10 × 2·8 mm. instead of 9 × 2·1 mm.), the veins towards the apex with much more evident hair; R_{2+3} a little more than twice as long as R_3; cell M_1 as long as its petiole, instead of only half as long; cell M_3 longer, its sides more parallel. *Hypopygium*

* Adopting Alexander's view that there are five branches to the radius present, the short vein connecting R_1 and R_3 being R, not *r*.

(fig. 24) showing several small differences, particularly in the form of the ninth tergite and the basal lobes of the side pieces. The hypopygium of *T. claripennis* is shown for comparison in Pl. II. fig. 23.

A single male in the British Museum from Grantown, Elgin, 17 viii. 1911 (*Lt.-Col. Yerbury*).

T. schummeli sp. n. This is the form which Verrall recorded as *T. unicolor*, but Schummel had two species under this name which he distinguished by the difference in venation. I propose the above name for Schummel's *unicolor* var. b, the hypopygium of which is shown in Pl. II. fig. 21. The type is a male from Brodick, Arran; other specimens in the British Museum are from Sussex, Bucks, Carnarvon and Sutherland.

T. unicolor Schum. This species, as now restricted, seems to be rarer in Britain than *T. schummeli;* I have seen only three specimens, all taken by Mr. C. A. Cheetham in Yorkshire. One of these is remarkable in having a cross-vein in the lower basal cell, as in the Scandinavian *T. variinervis* Zett. Hypopygium, Pl. II. fig. 22.

Trichocera.

The work of Keilin and de Meijere on the early stages has shown that this genus has no relation with the Limnobiidae, but is, on the other hand, fairly closely related to *Anisopus* (*Rhyphus*) and it is now included in the Anisopodidae (Rhyphidae) as a separate sub-family. The adults differ from the Limnobiidae in the possession of ocelli; the shape of the scutum, which does not show the two rounded portions; the position of Cu_1a, always close to the outer margin of the discal cell; and also—perhaps a more important point than appears at first sight—in the fact that the legs do not at all readily break off. No doubt when the comparative morphology of the head and hypopygium has been studied in greater detail, important distinctions will be found in these organs. While accepting the position now assigned to *Trichocera* by Alexander, it will be convenient to deal with it in this paper. The British species at present known can be distinguished as follows :—

1. Wing-veins conspicuously hairy; Ax ending a little beyond the anal angle of the wing; eyes bare; last joint of palpi very long, whiplike; ovipositor very short and fleshy
Diazosma hirtipenne Siebke.

Wing-veins not conspicuously hairy; Ax ending a little before the anal angle of the wing; eyes pubescent; last joint of palpi only moderately elongate; ovipositor rather long and horny (genus *Trichocera*) . . . . . 2.

2. Abdomen conspicuously banded with ochreous . *annulata* Mg.
   Abdomen uniformly dark (except sometimes the genital segments) . . . . . 3.
3. Cross-vein *r–m* with a distinct dark cloud round it . . 4.
   Cross-vein *r–m* not clouded . . . . . 5.
4. A distinct cloud on and below base of Rs *maculipennis* Mg.
   No dark cloud on or near base of Rs . *regelationis* L.
5. R_{2+3} noticeably shorter than basal section of R_2; knob of halteres scarcely darkened . . . . *major* sp. n.
   R_{2+3} as long as or longer than basal section of R_2; knob of halteres blackish . . . . . 6.
6. Thorax almost entirely reddish; scape of antennae yellow *rufescens* sp. n.
   Thorax more or less darkened; scape of antennae dark . 7.
7. Wings slightly and uniformly infuscated; clasper of male hypopygium without basal tubercle . . *fuscata* Mg.
   Wings almost perfectly clear; clasper of male hypopygium with small basal tubercle . . . . . 8.
8. Smallish species; wings indistinctly pale at base; basal projections of side-pieces of male hypopygium forming a complete bridge . . . . . *hiemalis* Deg.
   Very small species; wings whitish at the base; basal projections of side-pieces of male hypopygium not meeting in the middle *parva* Meq.

As is evident from the above table, some of these species are distinguished by apparently trifling characters, but as I have never found a mixed swarm (adjacent swarms may be of distinct species), and the numerous pairs taken *in cop.* have always been similar, I think it probable that we are really dealing with distinct species.

D. hirtipenne (Siebke). I took a female of this species at Letchworth, vii. 1918. It flew in at an open window and settled on my arm while I was engaged in pinning some captures. The genus *Diazosma* appears to me to be amply distinct from *Trichocera*.

T. maculipennis Mg., has not, so far as I am aware, occurred in Britain outside the lowlands of Scotland.

T. major sp. n. (Pl. II. fig. 25).

A large, stoutly-built species, with entirely unspotted wings, but very distinct from the other members of the plain-winged group. *Head* blackish-grey; ocelligerous tubercle unusually large. Antennae in both sexes distinctly more elongate than usual, only the basal segment of the flagellum somewhat swollen, especially in the female. *Thorax* dark blackish-brown, scutellum and sometimes sides of praescutum reddish-tinged. *Abdomen* uniformly dark; genital segments lighter. *Hypopygium* as in fig. 25: the clasper without basal tubercle; basal projections of side pieces forming a complete bridge, which comes to a point in the middle; the paired appendages of the aedoeagus (parameres?) very short. Ovipositor longer and more slender than in the other British species, six times as long as its greatest breadth. *Legs* rather stout, femora rather light brown except towards the tips; tibiae darker; tarsi blackish. *Wings* with a slight smoky tinge, in the female more yellowish. Sc_2 well beyond the base of Rs, in some specimens as far as the length of the discal cell; R_{2+3} scarcely two-thirds as long as the basal section of R_2; cell M_1 much longer than its petiole; discal cell about twice as long as broad. *Halteres* rather longer than usual, entirely ochreous in the female, knob somewhat darkened in the male.

Length of body, ♂ 6–7, ♀ 8·5 mm.; wing, ♂ 7·5 × 2·8, ♀ 9 × 3·2 mm.

Type and two other males from Shefford, Beds., 17 xi. 1917 (*F. W. E.*); one other male from Shotover, Oxford, 14 ix. 1914 (*A. H. Hamm*); one female from Letchworth Herts., 12 i. 1921 (*F. W. E.*).

T. rufescens sp. n.

Allied to *T. fuscata* and *T. hiemalis*, and perhaps only a variety of one of them, but differs from both in the much redder thorax and in the structure of the hypopygium. The claspers, as in *T. fuscata*, have no basal tubercle; the basal projections of the side-pieces just touch in the mid-ventral line, but do not form a complete bridge as in *T. hiemalis*, and are rather differently shaped from those of *T. fuscata*; the curved parameres are very much shorter, less curved and less sharply pointed than those of *T. fuscata*, being shorter even than those of *T. hiemalis*. Length of body, 4 mm.; wing, 5 mm.

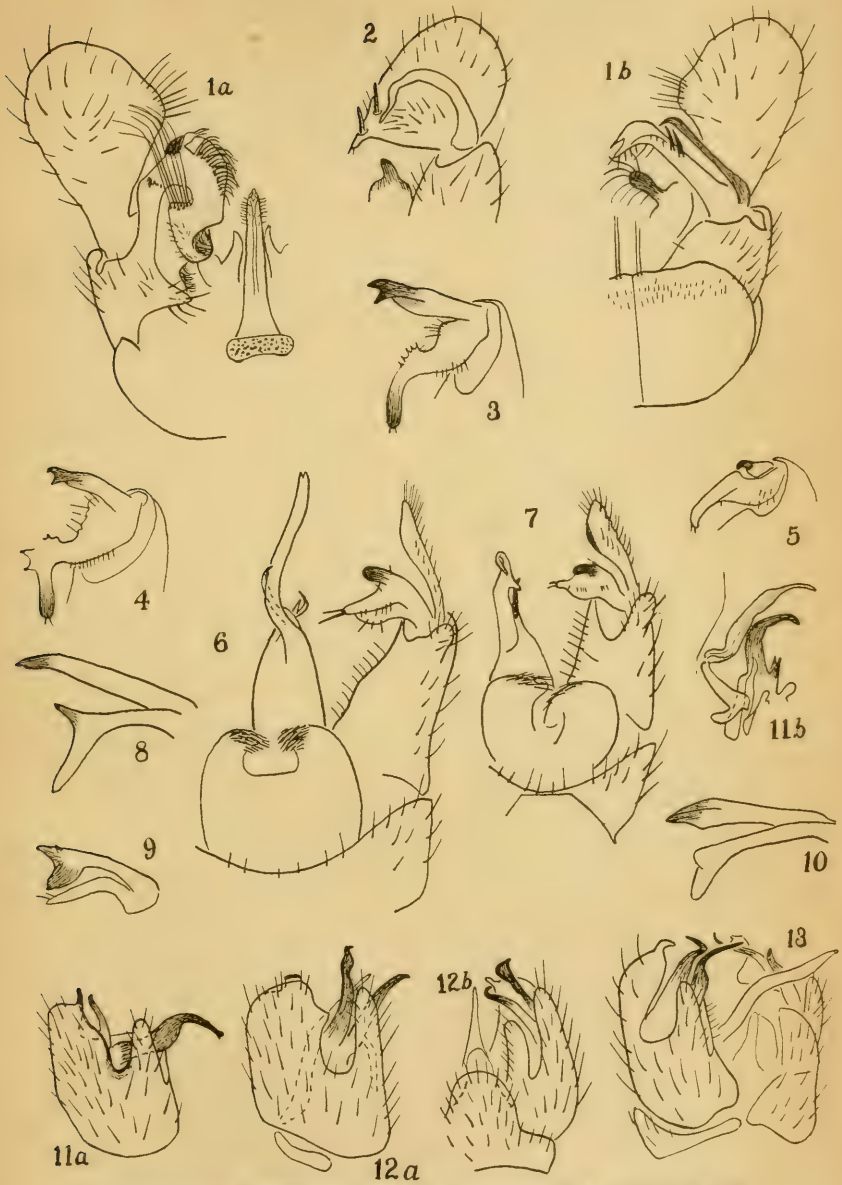
There are two males in the British Museum from Lelant, Cornwall, 28 viii. 1912 (*Lt.-Col. Yerbury*), and another in the Cambridge Museum from Logie, Elgin (*F. Jenkinson*).

The structure of the hypopygium will distinguish it from the somewhat reddish variety of *T. fuscata* which is not uncommon.

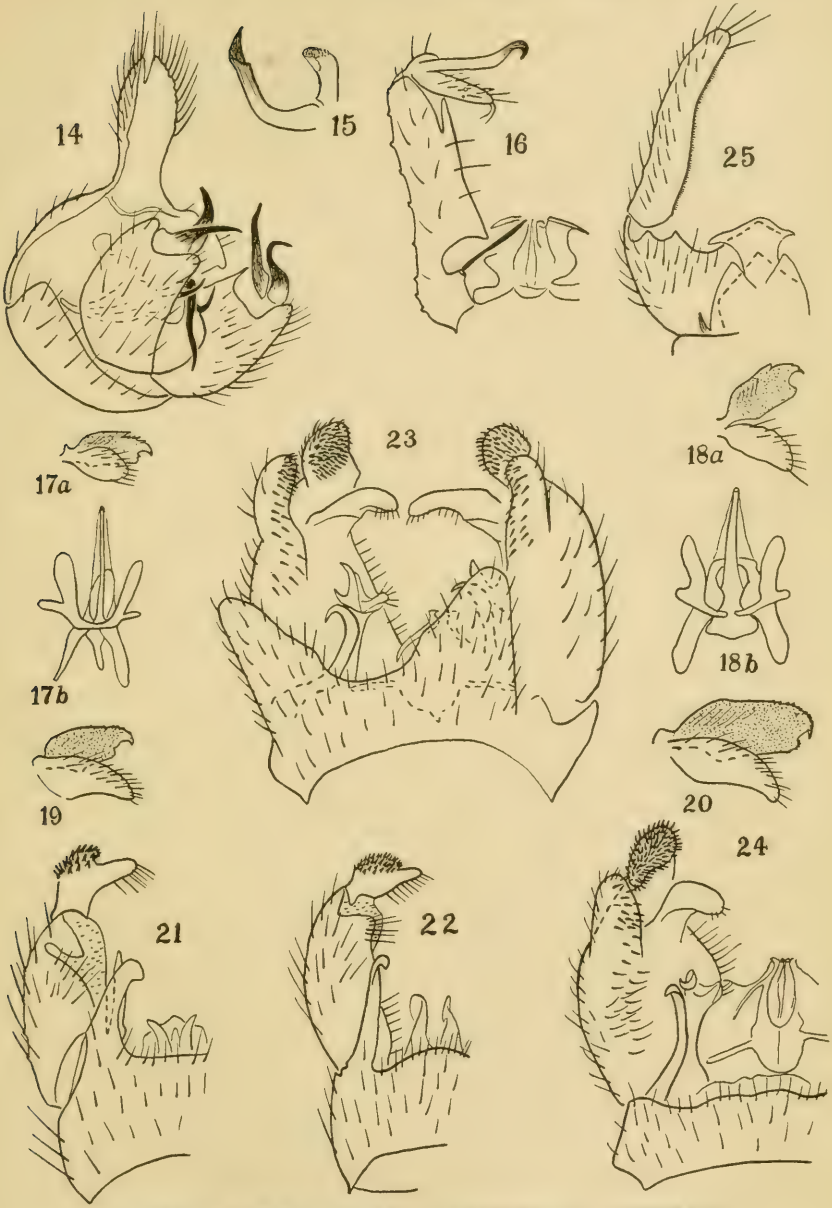
T. parva Meq. What I take to be this species has occurred at Letchworth, Herts., and Shefford, Beds., and is probably common elsewhere. It may be only a variety of *T. hiemalis*, but seems distinct by the characters given in the key.

Explanation of Plates I. and II.

Fig. 1. *Dicranomyia halterella* sp. n. Hypopygium : *a*, from below ; *b*, from above.
2. ,, *ventralis* Schum. Claspers, from above.
3. *Helius dubius* sp. n. ,, ,,
4. ,, *flavus* (Walk.) ,, ,,
5. ,, *pallirostris* sp. n. ,, ,,
6. *Gonomyia recta* Tonn. Hypopygium from above.
7. ,, *simplex* Tonn. ,, ,,
8. *Erioptera meijerei* sp. n. Claspers.
9. ,, *verralli* sp. n. ,,
10. ,, *nielseni* Meij. ,,
11. *Molophilus bifidus* Goet. *a*, hypopygium from side (aedoeagus removed); *b*, aedoeagus.
12. ,, *flavus* Goet. Hypopygium : *a*, from side, *b*, from beneath.
13. ,, *curvatus* Tonn. Hypopygium, half from beneath.
14. *Ormosia aciculata* sp. n. Hypopygium, half from beneath.
15. ,, *albitibia* sp. n. Claspers.
16. *Crypteria carteri* Tonn. (? = *Neolimnophila ultima* O.-S.) Hypopygium from above.
17. *Idioptera dalei* sp. n. *a*, claspers; *b*, aedoeagus.
18. ,, *apicata* (Lw.). ,, ,, ,,
19. ,, *mundata* (Lw.). Claspers.
20. ,, *marmorata* (Mg.). ,,
21. *Tricyphona schummeli* sp. n. Hypopygium from above.
22. ,, *unicolor* Schum. ,, ,, ,,
23. ,, *claripennis* (Verr.). ,, ,, ,,
24. ,, *lucidipennis* sp. n. ,, ,, ,,
25. *Trichocera major* sp. n. ,, ,, ,,



BRITISH LIMNOBIIDAE: HYPOPYGIAL DETAILS.



BRITISH LIMNOBIIDAE: HYPOPYGIAL DETAILS.

V. *The male genitalia of* Merope tuber *Newm.* (*Mecoptera*).

By F. Muir.

[Read March 16th, 1921.]

Plate III.

Merope tuber is of interest to morphologists on account of its synthetic characters. If *Grylloblatta* be considered as an order, then *Merope* should also be given that status. But I object to it in either case, for it places stress upon certain minor differences and ignores important similarities. For the same reason I object to the Heteroptera and Homoptera being considered as two orders, as the fundamental characters upon which the order Hemiptera is founded are the shape of the mouth-parts and their functions, and these are absolutely similar and homogeneous throughout both groups. If we do separate them, then it follows logically that the Homoptera be divided into two or three orders.

In *Merope tuber* the ninth tergite is produced into two flat processes divided off from the base of the tergite by a suture. The ninth sternite is produced in the middle into a narrow process which curves upward. There is little or no division between the tergite and sternite, and together they form a complete ring. Below the bifurcate tergite is the tenth segment in the form of a semi-membranous tube with the anus at the apex. At the base of the anal segment are the cerci. From between the projecting ninth tergite and sternite, and ventrad or anterior to the anal segment, arises the genitalia in the shape of a large pair of forceps with a small copulatory organ between. The forceps consist of a large basal piece (on each side, amalgamated at their bases), and an apical joint. If we consider the base as the coxites of the ninth sternite, then the apical portion would be the styles. On the dorsal aspect the bases are joined together by a thick rim of chitin, while on the ventral aspect they have a wide connection, with a strengthening Y-shaped thickening of chitin (fig. 4 *e*), the forks of which surround the opening where the copulatory organ is situated.

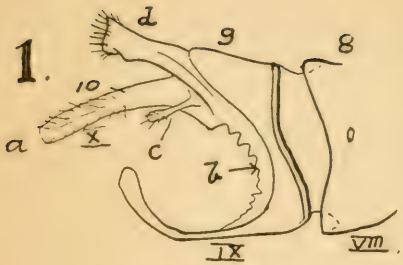
This organ (fig. 6) consists of two pairs of small processes, an anterior or ventral pair (*h*) which are small and pointed and have their bases continued as two membranous flaps (*i*). There is a round sclerite (*k*) at the base of each of these processes, to which is attached a long strut; the posterior or dorsal pair are larger and rounded at apex (*g*). A strong chitinous apodeme (*l*) connects these processes with a strong, chitinous U-shaped body (*f*), which is attached to the framework round the orifice in the fork of the coxites. This internal structure gives attachment to the muscles which actuate the organ. The opening of the ejaculatory duct lies near the base of the anterior processes.

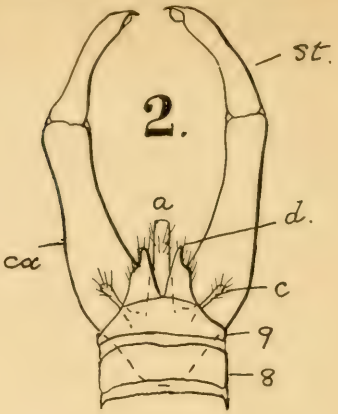
The penis of many insects is complex and our knowledge so slight that to attempt to homologise the various parts composing it is, at present, only a confession of faith and not a statement of fact. In certain Homoptera (*i. e.* Issidae, Ricanidae, Flatidae, Lophopidae), besides the paired genital styles (and probably a second pair amalgamated with the pygofer in the Fulgorids but found free in Tettigonidae, Membracidae and some Cercopidae), we find a penis composed of three tubes one within the other. The outer or the middle tube often bears complex appendages. In Coleoptera and some Diptera (*i. e.* Tabanidae) we find complex organs situated on the internal sac at the opening of the ejaculatory duct. When discussing the homologies of the penis it is therefore necessary to consider all these structures.

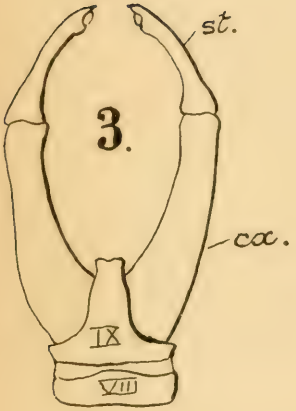
Although the coxites and styles are greatly developed in this species of *Merope*, the rest of the genitalia are not so specialised as in many of the Mecoptera.

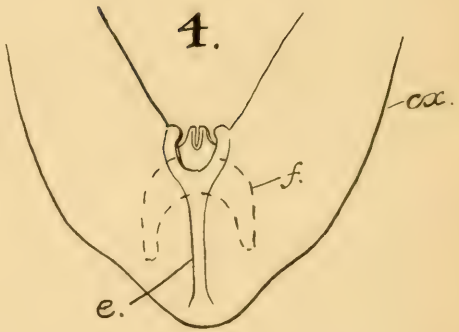
The coxites in this species would appear to be homologous with the dorsal valvulae of the female ovipositor, and the structure between them would then represent the inner valvulae. It is this latter structure which apparently undergoes such strange developments and forms the penis, or entirely disappears and leaves a membrane on which the ejaculatory duct opens.

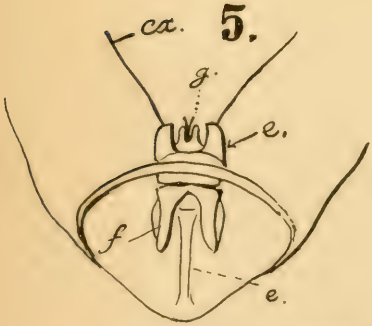
I have to thank Dr. R. J. Tillyard for the pleasure of dissecting this interesting insect. It is not every entomologist who would allow such a rare specimen to be cut up.

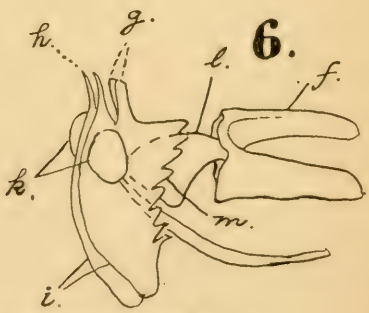












MALE GENITALIA OF *MEROPE TUBER*.

Explanation of Plate III.

Fig. 1. Lateral view of last three abdominal segments with the aedeagus dissected away.
2. Dorsal view of same with aedeagus present.
3. Ventral view of same.
4. Ventral view of base of coxites.
5. Dorsal view of same.
6. Genitalia dissected from fork of coxites.

a. Anus.
b. Torn membrane connecting aedeagus with body.
c. Cerci.
cx. Bilobe process of 9th tergite.
e. Y-shaped structure strengthening fork of coxites.
f. U-shaped structure.
g. dorsal or posterior processes.
h. Ventral or anterior processes.
i. Membranous flaps.
k. Round sclerite with strut.
l. Chitinous structure actuating organs.
m. Torn membrane connecting with Y of coxites.
8, 9, 10. Tergites.
viii, ix, x. Sternites.

VI. *Notes on the* Rhopalocera *of the Dollman Collection.* By N. D. Riley.

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[Read March 16th, 1921.]

Plates IV—VII.

It was hoped when the collections formed by the late Hereward Dollman in N.W. Rhodesia were presented to the Museum that a catalogue of them would be published. This project having seemingly fallen through, I have thought it advisable to publish the following notes now, hoping at a later date to be able to publish the much fuller and more interesting notes contained in Dollman's numerous diaries, and to figure the larvae of which he made so many extraordinarily good drawings.

Any remarks which I have taken direct from Dollman's MS. notes and diaries are placed in inverted commas in the ensuing descriptions, etc. With regard to the species of the genus *Catochrysops*, the new species contained in the collection will shortly be described by Mr. G. T. Bethune-Baker in a paper on that genus. They are therefore not included here.

PAPILIONIDAE.

1. **Papilio mackinnoni theodori**, subsp. nov.

(Plate IV, fig. 1, ♂; 2, ♀.)

♂, ♀. Coloration and pattern as in *P. m. mackinonni* E. M. Sharpe, but all the yellow spots forming the transverse band on forewing larger; the three subapical ones only slightly larger, the remainder at least half as long again, broader and more rectangular in shape. Two yellow patches are present just beyond apex of cell, of about the same size as the three subapical ones, and a smaller yellow spot within cell against base of vein 5. The hind-wing macular band in both sexes is almost exactly as in typical *mackinonni*, none of the twin-spots being united in the ♂, the corresponding spots in ♀ differing by being proximally more truncate and at the same time rather larger. Below, the same differences hold good, the macular band of hind-wing being in the ♂ perhaps slightly narrower than in typical ♂♂ of *mackinonni*.

B.M. Type No. Rh. 050, ♂, Solwezi, N.W.R. 14 i. 1918.
B.M. Type No. Rh. 051, ♀, Solwezi, N.W.R. 1 iv. 1918.

In addition there are 14 ♂♂ and 14 ♀♀ in B.M. taken by Dollman in various localities in N.W. Rhodesia.

The series shows a fairly large amount of variation. In one male the upper subapical and postcellular spots are united, as also are the lower ones, whilst the middle subapical spot is very large, but not quite united with either of the others; in several the twin-spots of hind-wing band are more or less united. In the females one specimen has two large yellow spots in the cell distally, but this would appear to be unusual, though many show a tendency towards additional yellow markings in this area, and just beyond end of cell, and also a tendency towards the union of the subapical and postcellular spots as in the male specimen referred to above.

Dollman states that he has "carefully examined the type of *P. mackinnoni benguellae*, Roths.," and that "it is quite different from this race."

PIERIDAE.

2. **Mylothris rüppellii** Koch.

Pieris rüppellii Koch, Indo-Austr. Lep. Fauna, p. 88, 1865.

This species, judging by the series in the Dollman Coll. and in the B.M., would appear to fall readily into several geographical races.

(a) *M. rüppellii rüppellii* Koch.

Described by Koch as having the basal suffusion of hind-wing of same colour as that of fore-wing. He only mentions the male, and gives "Abyssinia" as locality. No Abyssinian specimens in the B.M. agree with his definition. See below.

(b) *M. rüppellii kikuyuensis* Bart.

Mylothris rüppellii, ♀-form *kikuyuensis* Bartel, Nov. Zool. xii, p. 150, 1905.

This name is best applied to the form occurring throughout the greater part of Br. E. Africa, Uganda and the Kilimanjaro District, although first described by Bartel from the female only. It is characterised in both sexes by the redness of the basal suffusion of fore-wing, which thus

contrasts strongly, more particularly in the male, with the yellow of the hind-wing. Typical females have the hind-wing yellow basal suffusion largely replaced by the same red, but seldom completely so. The marginal markings are rarely very heavy.

45 ♂♂, 24 ♀♀ in B.M. from Kikuyu (typical ♂♂ and ♀♀), Nyeri, Sotik, S.E. slopes of Mt. Kenia, S. Kavirondo, Nandi Plateau, S. slope of Mt. Elgon, Yala R., Njoro, Eastern Mbale, Mt. Kokanjero, Taveta, Old Moschi, etc.

On Mt. Kenia the normal male seems to be almost entirely replaced by

M. r. kikuyuensis, ♂-form *kenia*, f. nov.

in which the ground-colour of both wings above is a delicate lemon-yellow instead of being white, and a trace of red is present in the yellow hind-wing basal patch. In all other respects it resembles typical males of *kikuyuensis*.

B.M. Type No. Rh. 052, ♂, S.E. slopes of Mt. Kenia, 6000–7000 ft., 4 ii. 1911 (*S. A. Neave*). In the B.M. there are in addition eight other ♂♂ taken with the type, and one ♂ from Godeb River, Abyssinia, 25 iv. 1902 (*Wagen*).

M. r. kikuyuensis, ♀-form *kaffana*, f. nov. (Plate V, fig. 3).

In this form of the female the wings are semi-transparent, the basal suffusions of both wings are very faint on the upper surface, though present; almost absent on hind-wing, present and practically normal on fore-wing, below.

B.M. Type No. Rh. 053, ♀, Inderatcha Forest, at Bonga, Kaffa, Abyssinia, 6050 ft., 4 vi. 1905 (*Ph. Zaphiro*); another ♀, Kaffa, Abyssinia, 1909 (*C. W. Gwynn*).

This form of the female is very close to some female examples of *M. erlangeri* Pagenstecher, from Abyssinia. So close in fact as to lead one to think that *erlangeri* itself may be only an extreme yellow race of *rüppellii*.

(c) *M. rüppellii rhodesiana*, subsp. nov.

(Plate V, fig. 1 ♂, 2 ♀.)

♂. With fore-wing basal suffusion much paler orange—no suggestion of red. Marginal markings heavier than in preceding subspecies.

♀. Basal suffusion of all wings the same colour, dull, pale orange, much duller than in ♂, extending beyond cell in both wings, tingeing the whole of interspaces 1*a*, 1*b*, 2 and parts of the others, also form-

ing a faint border in which are set the marginal spots on fore-wing: in hind-wing suffusing the whole, more faintly towards the margins, the distal parts of veins remaining whitest. Marginal markings heavy, apical black interrupted by two longitudinal yellowish streaks. Below, the orange suffusion of fore-wing extends to little more than basal half of wing, remainder white, seven marginal spots small. Hind-wing below with basal orange streaks in area 8 and faint suffusion of pale orange in and below cell, remainder white, marginal spots as above.

B.M. Type No. Rh. 054, ♂, N.W. Rhodesia, Kashitu, ii. 1915 (*H. C. Dollman*).

B.M. Type No. Rh. 055, ♀, Solwezi, iii. 1917 (*H. C. Dollman.*)

In addition 11 ♂♂, 7 ♀♀, ii. iii. vi. and viii. Yiafusa R., Kashitu and Solwezi (*H. C. Dollman*); Kambove, Katanga, Congo, 3 ♂♂ (*S. A. Neave*); Nyasaland, between Katunga and Mandala, 3 ♂, Blantyre, 2 ♂, 1 ♀, Zomba, 1 ♀; Angola, Chibokive country, 1 ♂.

This very distinct form is characteristic of Northern Rhodesia and Nyasaland, extending to the Katanga District of Belgian Congo and to Angola. It is on the whole decidedly a larger insect than the Uganda and E. African race, more heavily marked and much paler. One ♂ from the Itumba District of German E. Africa, in B.M., is in my opinion referable to this race.

(d) *M. rüppellii haemus* Trimen.

Pieris haemus Trim., Trans. Ent. Soc. Lond., 1879, p. 342.

This, the better known S. African race, is characterised in the males by having the basal suffusion of fore-wings of a rather brick-red shade, more nearly resembling that in typical *rüppellii*, the same colour to a large extent suffusing the yellow hind-wing basal area as well; in the females by the far greater (sometimes complete) and basally rather redder suffusion of all wings above and by the fore-wing apical black patch not being broken up in any way.

Mashonaland 5 ♂♂, 3 ♀♀; "Zambesi" 1 ♂; "Kaffraria" 1 ♂.

3. **Mylothris dollmani**, sp. nov.

(Plate V, figs. 4–6.)

♂. *Upperside.* Both wings pure white. Fore-wing basal third (mainly owing to underside coloration showing through) very faintly

yellowish-pink, sprinkled proximally with grey scales. Interspace 12 black, thickly sprinkled with grey scales, the black continuing narrowly along costa, widening at vein 10 to form a black apical patch the inner edge of which joins the top of black marginal spot at end of vein 5. This spot about 2·2 mm. in diameter. Similar spots present at ends of veins 4, 3, 2 and 1, decreasing in size, the one at end of vein 1 very small. Hind-wing with similar slight basal suffusion, tinged with yellow at base of interspace 7. Black marginal spots present at ends of veins 1*b*–6, those at ends of 2, 3 and 4 twice the size of the others, about equal in size to the one at end of vein 4 of fore-wing.

Underside. Both wings pure white. Fore-wing base orange, filling the proximal halves of interspaces 10 and 11 (but not 12), the cell as far as discocellulars, a small triangular area at base of interspace 2 and base of 1*b* level with this. Costa white. A black spot at the end of every vein including 10, 11, 12 and 1. Apical black of upperside shows through slightly. Hind-wing similarly orange at base, the orange filling area 8 of same colour as fore-wing, remainder filling 7, the cell as far as discocellulars, base of 2, basal half of 1*c* and faintly colouring bases of 1*a*, 1*b* and 6, paler. Marginal spots as above.

Body with a well-defined lateral sulphur-yellow stripe.

Length of fore-wing 3·1 cm.

♀. *Upperside.* Fore-wing white, the cell, and areas 1*a*, 1*b* and 2 filled with pale ochreous; 3, 4 and 5 with a wide central streak of same colour, but paler, leaving the areas immediately alongside the veins white; 9, 10 and 11 also faintly ochreous. Black markings as in ♂, but spots at ends of vein rather larger. Basal grey scaling heavier. Hind-wing rich ochreous, paler in areas 1*a*, *b* and *c*. Marginal spots as in ♂, but rather larger, fringes white between the marginal spots.

Underside. Fore-wing white, suffused with rich ochreous, exactly corresponding with pale ochreous areas of upperside. Veins distally white. Black markings as in ♂. Hind-wing as above, but of richer ochreous, and having veins white or whitish.

Body laterally with less well-defined sulphur yellow stripe than in ♂.

Length of fore-wing 3·1 cm.

B.M. Type No. Rh. 056, ♂, N.W. Rhodesia, Solwezi, iii. 1917 (*H. C. Dollman*).

B.M. Type No. Rh. 057, ♀, N.W. Rhodesia, Solwezi, i. 1917 (*H. C. Dollman*).

M. dollmani, ♀ form *flavida*, f. nov.

(Plate V, fig. 6.)

A form of the female in which the ochreous coloration has entirely displaced the white of fore-wing above and confined it below to an area approximately corresponding with that of the black apical patch of upperside.

B.M. Type No. 058, ♀, N.W. Rhodesia, Solwezi, 14 iii. 1918 (*H. C. Dollman*).

In addition there are 12 ♂♂, 10 ♀♀ in B.M. (Dollman Coll.) from the same locality, all taken during Jan.–April 1917 or 1918, also 1 ♀ from Lualaba Valley, Kansanshi, N.W. Rhodesia, in Coll. Adams in B.M.

This very distinct species bears a strong superficial resemblance to *M. agathina* Cram., but the white apical area of underside of fore-wing separates it at once. Dollman, though separating the species in his collection, does not refer to it in his MS. notes. Judging by the perfection of the specimens in his series the majority would seem to have been bred.

SATYRIDAE.

4. **Mycalesis cooksoni latior**, f. nov.

(Plate IV, fig. 3 ♂, 4 ♀.)

Druce's description and figure (Trans. Ent. Soc. Lond., 1905, p. 251) are taken from a male of the dry-season form. In the wet-season form the insect is of a rather richer and deeper coloration and slightly smaller. The subapical yellowish band of fore-wing above is much paler and wider, in the male extending as far as, in the female often beyond, the small ocellus in area 5, and terminating squarely at vein 3. On the underside the differences are what one would expect, *i. e.* an almost entire absence of striation, the ocelli all well developed, the pale yellow markings more developed, the basal halves of the wings evenly dark grey-brown, cell markings almost absent. It seems best to name this ocellate form (= f. *latior*), but it is obviously to be considered only the wet-season form of *cooksoni*.

B.M. Type No. Rh. 138 ♂, 139 ♀, Solwezi, i. 1917 (*H. C. Dollman*).

5. **Mycalesis saussurei suffusa**, subsp. nov.

♂ ♀. Differ from typical *saussurei* Dewitz, by being entirely deficient of the transverse white band of the upper side of both wings. The position of this is indicated in the fore-wing by a slightly paler area; in the hind-wing hardly at all, the ground-colour having entirely displaced it. In addition the ocelli on fore-wing above are more in evidence than in the typical form, and the edge of the basal brown area of both wings below is straighter and encroaches more on the transverse white band, this latter and the remainder of markings of underside being otherwise typical.

B.M. Type No. Rh. 058, ♂, N.W. Rhodesia, Solwezi, 11 iv. 1918 (*H. C. Dollman*).

B.M. Type No. Rh. 059, ♀, N.W. Rhodesia, Solwezi, 11 iv. 1918 (*H. C. Dollman*).

In addition 11 ♂♂ from same locality. The specimens referred to by Neave (P. Z. S. 1910, p. 10)—of which there are 2 ♂♂, 2 ♀♀ in B.M. from "150 miles W. of Kambove"—belong to this form. They do, however, show rather more definite indications of the transverse white band of upper-side than do Dollman's specimens.

"Only found in forest country adjacent to the Solwezi River."

6. **Henotesia perspicua** Trimen.

Mycalesis perspicua Trimen, Trans. Ent. Soc. Lond., 1873, p. 104.

This species is represented by three forms :—

(a) *H. perspicua f. birsha* Hew (= *victorina*, Westw.).

Represented by six males taken between 31st January and 9th February 1917, at Mwengwa during the rains. They are of a very pronounced wet-season type. "Absent from Solwezi District."

(b) *H. perspicua f. perspicua* Trim.

Represented by eight males and four females all of one form, a more or less intermediate seasonal form, and taken near the Solwezi River between 24th Feb. and 13th April 1917, except for one specimen taken on 1st October 1917. These periods correspond, as far as I can ascertain, with the end and the beginning of the rains respectively.

(c) *H. perspicua f. simonsi* Butler.

Of this there are six males and nine females taken "at Mwengwa in August 1913 and in the Lukange Valley, Kashitu, in September 1915. Not seen at Mwengwa." Dollman goes on to say in his MS. notes that he "agrees with Marshall (Trans. Ent. Soc. 1896, p. 562) and Neave (P. Z. S. London, 1910, p. 10) that *simonsi* is the dry-season form of *perspicua*. The two localities" in which it was found "were very dry river valleys—of the Kafue and the Lukanga. Seeing that *perspicua* was not taken at Mwengwa, but that the closely allied form *birsha* was, the Mwengwa *simonsi* are probably seasonal forms of the latter."

An examination of the dates of capture of these three forms, and the form *teratia*, Karsch (a form intermediate between *perspicua* and *simonsi*), all occurring in N.W. Rhodesia and Katanga, shows that (1) in the middle of the rainy season (Jan.–Feb.) only *birsha* occurs, (2) at the beginning of the rains (Oct.–Nov.) and again at the end (Feb.–March) only *perspicua* occurs, (3) from March–July *teratia* is the predominant form, and (4) during July, August and Sept., the hottest and driest months, only *simonsi* occurs. There is very little overlapping in the series in the British Museum. These facts and the impossibility of fixing on any character—other than obvious seasonal characteristics—by means of which to separate these so-called species, point fairly conclusively to their being all forms of one and the same species, of which the oldest name is *perspicua* Trimen.

NYMPHALIDAE.

NYMPHALINAE.

7. Charaxes etheocles Cram.

P. etheocles Cram., Pap. Exot. ii, p. 34, pl. 119, figs. D.E., 1777.
(Plate VI, figs. 1–3.)

With regard to this and the next species I think it best to quote the whole of Dollman's very interesting MS. notes. The series of the two species were exhibited at the Entomological Society of London on 4th December, 1918, and a short account of them occurs in the Proceedings of the

Society, p. clxxvi, 1918. They are again referred to in the same publication, p. lxxv, 1919.

In Dollman's MS. notes there occurs the following with regard to *etheocles*. "This is a common and widely distributed species in N.W. Rhodesia. The males were taken at Mwengwa (rare): Mumbwa: Kashitu (abundant) and throughout the Solwezi sub-district. The first female was taken at damp mud by the Lukanga R., Kashitu—a typical specimen of the f. *manica* Trimen. Several females caught at Solwezi, mostly at bad bananas, a few drinking (rather unusual in females of Rhopalocera) and some at sap. The males seen in numbers at decomposing animal matter—one of the most readily attracted of all *Charaxes* by this lure.

"Larvae found in January–July and in October, mostly on *musasi*, a kind of acacia, but one on *musubo* and one on *kafundula*, the latter both Leguminous trees. Not found in such numbers as the next species, though by far the commoner in the perfect state, probably on account of the profusion of the *musasi* trees, which are tall and slender and mostly very inaccessible. One larva which pupated 3 vii. 1917, emerged 31 vii. 1917—28 days."

The series contains 20 ♂♂, all of the ♂-form *cytila* Rothschild, 19 ♀♀ of the ♀-form *manica* Trimen, 1 ♀ of ♀-form *phaeus* Hew., and the dates of capture or emergence cover the months Feb. April, July, August and December, but Dollman speaks of having "both bred and caught specimens taken throughout the year." and states that they show "little seasonal variation." Those of the wet season, however, are more heavily and richly marked on the underside than are the dry-season specimens.

8. **Charaxes fulgurata** Aurivillius.

Ch. fulgurata Auriv., Rhop. Aethiopica, p. 236, 1898.

(Plate VI, figs. 4 and 5.)

"A much more restricted species than the preceding; only found at Solwezi, about 100 miles from the Katanga boundary. Very few imagines caught—mostly at fruit, both sexes. It would seem to be very little attracted by animal matter, differing markedly in this from *C. etheocles*.

"The larva was *always* found on *kabulwebulwe*, a species of acacia, usually several on a shrub. Although when fully grown this makes a magnificent and beautiful tree, it is

rarely met with except as a small and easily searched shrub. Many hundreds of larvae were obtained in this way—such of the larger trees as were searched gave no results whatever."

In the larval state the two species may be readily differentiated by their heads. In *fulgurata* the cephalic horns are long, rather pointed and broadly red-brown at apex; in *etheocles* they are "short and blunt"; and further, in *etheocles* "*all* the larvae had the median pair of small points [between the larger cephalic horns] light yellow," whilst in *fulgurata* they "are always black or very dark."

"The larvae were found during every month of the year except August, during which month the *kabulwebulwe* is leafless. The eggs are laid on the upper surface of the leaves. The pupal stage lasts from three weeks to a month."

This species has hitherto usually been considered a form of *etheocles*. But the two species occur together, and are readily separable without fear of confusion. The chief points in which the male of *fulgurata* differs from that of *etheocles* are: the rather lighter, bluer shade of the blue-green ground-colour, the size of the two subapical spots—much larger and more crescentic in *fulgurata* than in any race of *etheocles*—the fusion of the submarginal dark green spots with the marginal strip of the same colour, and the length and conspicuousness of the internervular marginal pale lines. Dewitz gives an excellent figure of the male in Nov. Act. Ac. N. Cur., Vol. 50, t. 17, f. 10 (1887), under the name of *C. ephyra* var. The size and shape of the two subapical spots and the submarginal and marginal markings of the female correspond very closely to those of the male and serve to distinguish it readily from females of *C. etheocles*. All the females obtained by Dollman correspond to the *phaeus* form of *C. etheocles*, and may be known as ♀ f. **mima**, form nov. (B.M. Type No. Rh. 060 ♀). I see no reason to suppose that the female figured by Dewitz (l.c.), and having a white band to the fore-wing, is not also a female of this species. The marginal markings are identical with those of ♀ f. *mima*, and by no means those of *C. etheocles*, ♀ f. *manica* Trim. This form has been named f. *lunigera* Roths., Nov. Zool. vii, p. 488, 1900.

Further evidence of the distinctness of *C. etheocles* and *C. fulgurata* lies in the particulars as to differences in the larvae, food-plants and imaginal habits given by Dollman. And, in addition, a series of preparations of the genitalia

shows a constant difference in the form of the penis. In *C. fulgurata* the large toothed ridge just distal from the bend is replaced by a slight toothed swelling. This difference was at first thought to be individual, but it is actually constant in all the specimens examined.

16 ♂♂, 15 ♀♀, ii. iv–viii. x. Solwezi.

9. **Precis actia** Dist., forms, **actia** Dist., and **furcata**, R. and J., and

10. **Precis pelarga** Fab. f. **leodice** Cram.

It is interesting to note that Dollman was convinced of the specific distinction of these two species, which had always been considered one until separated by Rothschild and Jordan (Nov. Zool. x, p. 516, 1903). He regarded the commoner species however (*P. actia* Dist.) to be *P. pelarga* and thought this latter a new species. His females of *P. pelarga* f. *leodice* are of the more unusual form which resembles the male in coloration and is quite devoid of any trace of bluish or white suffusion of the yellow band on both wings. A character which may be of some use to help to separate these two species is the shape of the outer edge of the basal black area of the fore-wing. In *P. actia* it is, *as a rule*, much more crenulate, especially posteriorly, than in *P. pelarga*: it nearly always runs in an even curve in areas 2 and 3 in *P. pelarga*, but is interrupted on vein 3 in *P. actia*. The only certain guide, however, is the shape of the clasper in the male, as indicated by Rothschild and Jordan (l.c.).

ACRAEINAE.

11. **Acraea welwitschi** Rogenh.

Acraea welwitschi Rogenh., Verh. z.-b. Ges. Wien. 42, p. 573.

(a) *A. welwitschi lutea*, subsp. nov.

(Plate V, fig. 7.)

A series of 11 ♂♂ from Mutema's in the Lukanga Valley, Kashitu, taken during August 1917, exhibits little variation. They are nearest to the subsp. *lobemba* Eltr., but differ constantly in having the fore-wing apical and hind marginal black restricted to about half the width, in having a generally paler ground-colour, with distinct ochreous tinge in the fore-wing discal area, and very slightly more pronounced white in discal area of hind-wing.

B.M. Type No. Rh. 063, ♂, Mutema, Lukanga Valley, Kashitu, N.W. Rhodesia, 10 viii. 1918 (*H. C. Dollman*).

Length of fore-wing 3·1 cm.—some specimens a good deal smaller.

(b) *A. welwitschi nivea*, subsp. nov.

(Plate V, fig. 8.)

1 ♂ (B.M. Type No. Rh. 064) from Solwezi, August 1917 H. C. Dollman, differs considerably from the preceding. The black basal area of fore-wing does not nearly reach vein 2; the spot on discocellulars is minute; the black costal mark beyond is narrow, and only reaches vein 5, being followed by a small separate spot in area 4; ground-colour and margins as in *A. w. lutea*. The hind marginal border of hind-wing is very broad, reaching nearly to edge of cell in areas 3 and 4 particularly, where it gives place to white, which extends in an almost rectangular patch from inner margin to vein 6, and in the cell nearly reaches the base of vein 7; basal black of hind-wing of normal extent; remainder of areas 5, 6, 7 and 8 of normal salmon-pink coloration.

I should have hesitated to add another name to the burden of this species on an examination of a single specimen, were it not that Dollman says that "it is common in woodland parts of the Solwezi District and that all the specimens were similar to the one (the type) in his collection; of those caught there was little, if any, variation."

12. **Acraea guillemei** Oberth.

A. guillemei Oberth., Études d'Ent. xvii, p. 19, 1893.
A. diogenes Suffert, D. E. Z. Iris, xvii, p. 114, 1904, ♀.
A. acutipennis Lathy, Trans. Ent. Soc., p. 3, 1906, ♂.
A. lactea Neave, P. Z. S., p. 20, 1910, ♀.

"2 ♂♂ taken 30 xiii. 1917 at Solwezi, one actually *in copula* with a ♀ *diogenes*, Suff., and the other in close attendance on the pair, seem to furnish conclusive evidence as to the specific identity of these two named forms. The analysis of the spots, particularly of the hind-wings, confirms this. In addition 3 ♀♀, xii. 1917, and 1 ♀, i. 1918, also at Solwezi. Probably a woodland species and not met with elsewhere."

LYCAENIDAE.

THECLINAE.

13. * **Hypolycaena japhusa**, sp. nov.

(Plate VII, figs. 9 and 10.)

♀. *Upperside, fore-wing :* Ground colour pale grey, apical third beyond a line from origin of vein 7 to anal angle considerably darker grey; a broad crescent-shaped white band from apex of cell to inner margin, broadest at vein 2 and including distal part of cell, the edges shading gradually into ground colour, about 4 mm. broad at inner margin; the discocellulars grey. *Hind-wing :* the bases of areas 1*a*, 1*b*, 1*c*, 2 and 4 and the whole of areas 5, 6, 7 and 8 of same grey as ground colour of fore-wings, remainder white, the markings of underside repeated faintly, except the black marginal spot in area 2, which is heavier above than below.

Underside, both wings : pure white. *Fore-wing :* discocellulars very faintly marked with grey, discal band dull brown, rather interrupted, submarginal and marginal bands very fine and faint. *Hind-wing :* discal yellow band very narrow and considerably broken, finely black-edged interiorly, sharply angled in 1c thence to inner margin at extremity of vein 1*a*; submarginal band very faint and cloudy, the marginal line very fine and well defined; anal black spot small, surmounted by yellowish scales inwardly, metallic blue outwardly; marginal black spot in area 2 surrounded on the inner side by pale ochreous; no spot in area 7.

Length of fore-wing, 15·5 mm.

B.M. Type No. Rh. 065, ♀, 27 viii. 1915, Yiafusa R. (a tributary of the Lukanga River), near Kashitu, N.W. Rhodesia (*H. C. Dollman*).

This may prove to be a form of *H. hatita* Hew., with which it agrees completely as to the arrangement of its underside

* Since writing the above Mr. Talbot has found what we consider to be the male of this species in the Witley Museum, and has kindly furnished me with the following short description :—

♂ *Upperside* resembling *hatita* Hew., and *ugandae* Sharpe. *Hindwing* with white submarginal spot in 3 strongly developed, the two in 4 and 5 indistinct. *Underside* as in Uganda form, with thinner and straighter post-discal lines.

Length of fore-wing, 15 mm.

Hab.—Kikura River, Lufira Valley, S.E. Congo, 14 v. 1919, 1 ♂ allotype. In addition 1 ♀, 5 iv. 1919, same locality; and 1 ♀ from Buluo River, Lufira Valley, May 1919; all collected by T. A. Barns.

markings, though differing in the *size* of them. This, and the large white central area of fore-wing and the white posterior half of hind-wing readily separate it from normal *H. hatita*, specimens of which are in the B.M. from Kambove, Katanga, in the Belgian Congo, just north of N.W. Rhodesia. A very similar form occurs in Uganda (*H. ugandae* E. M. Sharpe, Entom. 1904, p. 203).

14. * **Spindasis cynica**, sp. nov.

(Plate VII, figs. 11 and 12.)

♀. *Upperside, fore-wing :* the disc of wing ochreous, costa and hind margin very broadly black, the ochreous colour extending partly into distal half of cell and filling approximately the upper half of area 2. Four heavy black marks are conspicuous in the discal ochreous area, viz. across cell end, in area 5 midway between cell end and hind margin, in area 4 distally, and across proximal part of area 3 and central part of area 2, this last spot produced in fact towards anal angle, where it joins the marginal border and forms a large dark area. A light blue suffusion covers most of the proximal half of the wing, but does not extend much into cell anteriorly. Fringes white, spotted with black at the ends of the veins. *Hind-wing :* dark grey-brown, costal area and an oblong spot extending from vein 3 to vein 5, rather nearer margin than cell, and a broad ill-defined sub-marginal band, all darker. Marginal border narrow and black. Abdominal area light grey. A light blue suffusion as in fore-wing extends from base to tornus, but does not extend to costal,

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* As in the case of the preceding species, I am here again indebted to Mr. Talbot for a description of the male of this species, which we have both examined.

♂. *Upperside* blackish-brown. *Fore-wing* with a pale ochreous patch outside the cell in cellules 4 and 5, an indistinct spot of similar colour in the cell, a small spot at base of 3, and a larger one below it in 2; proximal three-fourths of cellule 1*b* pale blue, extending into the base of 2 and lower basal part of cell, also slight blue scaling below the submedian. *Hind-wing* with slightly paler areas indicating obscure dark marginal band and a post-discal spot. Inner margin grey.

Underside markings as in the female.

Length of fore-wing, 15 mm.

Expanse, 32 mm.

Hab. Kikura River, Lufira Valley, S.E. Congo, 5 v. 1919 (*T. A. Barns*), 1 ♂, allotype, in Coll. Joicey.

terminal or abdominal areas, and is partly obscured by a profusion of long pale grey hair-scales. Tails black, their extremities white, each with a small ochreous spot at origin. Fringes as in fore-wing.

Underside, both wings: creamy white with numerous black-edged silvery markings; fringes as above. *Fore-wing:* a small basal spot black, and a black sub-basal spot anteriorly filled with silver, within cell, both irregular in outline. A black costal streak runs from base and ends abruptly, level with the sub-basal cell-spot. An anteriorly broader black-edged irregular silvery bar across centre of cell from costa to vein 2. The base of wing below the cell and as far as this bar black. Beyond cell are three costal spots, also silvery, the first joined to the similar bar across cell end, the second free, and the third inwardly and posteriorly joined to a similar spot most of which lies in area 5. There is a similar somewhat crescentic apical spot, and another dumb-bell-shaped one mostly in area 4 below, external to and touching that mentioned as being mostly in area 5. Marginally in area 4 is a large subquadrate black spot barely touched with silver. A broad black band, only silvery anteriorly, runs from just above vein 4 to tornus and is twice angled in its course. The narrow black marginal line is preceded by a double row of fine wide V-shaped black marks. *Hind-wing:* similar, heavy, silvery, black-edged spots to those of fore-wing are present basally and costally, namely, a large circular one in area 7, touching the dark basal mark, and two distally, oblong, also in area 7, partly joined together and joining a similar one between them in area 6. The cell contains a round black basal spot and an irregular silvery central one, and has a silver bar across discocellulars edged with brown, not black. The bases of areas 1*a*, *b* and *c* are occupied by mottled brown and black with some silver distally. Between these and the marginal markings, which latter are as in fore-wing, the bulk of the surface is occupied by irregular silver bands and spots which are narrowly edged with black or brown, and are apparently produced by the coalescence of discal and subdiscal bands. The anal angle bears a clear black spot, and the tails are as above.

Antennae black, proximally ringed with white. Head above grey, below creamy yellow; palpi above black, below creamy yellow. Thorax and body above dark grey with bluish tinge, below pale grey, the latter striped laterally with white at each segment.

Length of fore-wing, 18·5 mm.

B.M. Type No. Rh. 142, ♀, Solwezi, v. 1917.

This distinct species, of which unfortunately only the one specimen was obtained, is nearest to *Spindasis iza* Hew., *S. menelas* H. H. Druce, and *S. crustaria* Holl., but is readily separable from all of them.

15. **Aphnaeus affinis**, sp. nov.

(Plate VII, figs. 7 and 8.)

♂. *Upperside, both wings :* rich reddish-brown with faint coppery reflections, the veins, especially towards costa, black : hind margins with a fairly even very dark brown band, about 1 mm. wide. *Fore-wing :* areas 8, 9 and 10 entirely black, a small dark grey area at base of area 1*a* : an oval central spot in cell, a larger irregular one at cell end, a smaller rather indistinct one in area 1*b* below origin of vein 2, and a discal row of five smaller ones, the upper two at least black-edged, in areas 3–7, the lower ones very indistinct, the central one of the series only slightly displaced outwardly, all brownish-yellow : fringes brown. *Hind-wing :* no other markings, anal lobe purplish-brown, tail brown, fringes slightly whitish posteriorly.

Underside, both wings : ground-colour purplish grey-brown with numerous large yellow spots. *Fore-wing :* area 12 almost entirely ochre-yellow, a subquadrate basal cell spot, a large oblong spot across the centre and large irregular spot across end of cell from just beneath costa and extending into area 3, the last two joined or almost joined by a small triangular spot in base of area 2, all of same colour; a discal band of yellow spots as above, but larger and with all spots well defined and, like those already mentioned, outlined with ferrugineous brown; area 1*b* contains a small basal spot and two very large irregular spots beyond, paler posteriorly, all three more or less confluent and partly outlined with blackish; a subterminal row of darker reddish-brown subtriangular spots; inner margin pale yellowish. *Hind-wing :* basal spots in areas 1*a* and 8, followed by a series of four large oval spots in 1*a*, 1*c*, the cell and 7, that in 1*c* much displaced outwardly; a large irregular spot at cell end; a discal series of nine spots in a semicircle from area 8 to 1*b*, the spot in 1*c* being split to form 2; of the series counting from costa, the 2nd (the largest) and the 4th and 5th (the smallest, except the 6th) are beyond and the 8th slightly before the others, the 2nd and 3rd more or less confluent, and also the 6th to 9th; this series is followed by a subterminal series of basally contiguous subtriangular rather darker yellow spots; a small crimson spot and some bluish scaling at anal lobe.

Antennae purplish, yellow-tipped; head and collar purplish to bronze—no yellow or grey; eyes, except above, broadly encircled with white; palpi below white, distally brown, the terminal joint purple; from above purple, the terminal joint black. Thorax and abdomen above covered with long fine bronze-green hairs; below, white. Legs, 1st pair interiorly purple, outwardly white, others the reverse, with less white.

Length of fore-wing, 17 mm.

B.M. Type No. Rh. 066, ♂, Chanteli R., Solwezi, viii. 1917 (*H. C. Dollman*).

Three further ♂♂ from same locality, 1 ♂ Chipupushi R., Solwezi, 22 viii. 1917. They show considerable variation in the amount of confluence of the underside yellow ochre markings. They are, however, constantly separable from *A. erikssoni* by many small details such as the absence of spots in hind-wing above, the position of central spot of discal band of fore-wing below and of the 2nd spot in the discal series of hind-wing below. The collar, too, between head and thorax in *A. erikssoni* is dark grey or black, the head yellowish and underside of thorax and body yellowish—all different from *A. affinis*.

1 ♂ from Lukanga R., 7 ix. 1915, which undoubtedly belongs to this species, is rather paler above and, below, has all the yellow markings much reduced, the smaller spots being entirely absent, and the others only half the normal size on the average, giving the insect a very different general appearance.

16. **Aloeides molomo mumbuensis**, subsp. nov.

(Plate VII, figs. 3–6.)

♂. *Upperside, both wings:* orange-yellow with large dark grey-brown areas. *Fore-wing:* hind margin broadly black from costa to inner margin, 3 mm. broad anteriorly, 4 mm. broad on inner margin, a large subquadrate darker area at cell end from costa almost to vein 4, joining the hind marginal band on costa and divided from it along remainder of its outer edge by a strip about 1 mm. wide of the orange ground-colour. *Hind-wing:* a similar spot in the same position, but reaching hind margin throughout, not extending beyond vein 4, a certain amount of black scaling between it and base of wing, and also in areas 1*a* and 1*b*, principally distally; margin narrowly black, having a crenate appearance. Fringes of both wings dark grey chequered with lighter.

Underside, fore-wing: pale greyish ochreous, a narrow orange stripe in cell and broader ones in areas 1*b*, 2 and 3; two black, silver-centred spots in cell, and double one on discocellulars, a discal row of six black spots inwardly silver edged, commencing with 2 in area 1*b*, the fifth very much beyond the series; a seventh obsolete spot above the series and 2 in 1*b* on inner side of those in series; a similar regular series of subterminal spots all but the lower three obsolescent; a marginal series of minute dark points; fringes as above. *Hind-wing:* ground-colour the same; basal area cloudily purplish-brown

followed by paler area; discal area similar, marginal area much paler; numerous rather brassy metallic spots, namely one basal one in cell, a sub-basal series of 4, a series consisting of a large spot on disco-cellulars and one each in 1*b* and 1*c*, and two discal series, each of eight sometimes almost obsolete spots, the outer series regular, the inner series with the 2nd, 4th and 6th spots (counting from costa) well beyond the others; a marginal series of grey spots.

♀. The same but with ground-colour slightly paler.

Length of fore-wing, ♂ 14 mm., ♀ 15 mm.

B.M. Type No. Rh. 067, ♂, 068, ♀. Both from Mumbwa, 1 ix. 1913 (*H. C. Dollman*).

Readily separable from typical *A. molomo* by the division of the black costal area from the reduced hind marginal border by the ground-colour in fore-wing and by the restriction of black markings of hind-wing to the area above vein 4. Below, the hind-wing is more evenly mottled in appearance. The narrow black border to the hind-wing above is very much as in *A. damarensis*, which is probably a local race of the same species.

In addition 4 ♂♂, 3 ♀♀ same date and locality. "Very local, being only found on one part of the plains in front of the Boma; often settling on the red-brown soil, sometimes on flowers."

17. **Aloeides griseus,** sp. nov.

(Plate VII, figs. 1 and 2.)

♂. *Upperside, both wings:* darkish grey-brown, with faint brassy reflections, fringes obscurely chequered with slightly paler greyish. *Fore-wing:* a very faint lighter mark on the discocellulars and indications of a submarginal series of oblong paler markings. *Hind-wing:* indications of a similar but even fainter series of submarginal spots, particularly posteriorly; margin rather dentate.

Underside, both wings: same colour as above, densely sprinkled with lighter, yellowish scales; the arrangement of spots the same as in preceding species. *Fore-wing:* the white, hardly metallic parts of spots very conspicuous, the submarginal series more even, marginal series barely traceable. *Hind-wing:* many of the spots hardly traceable, remainder brassy-yellow and very indistinct, not metallic.

♀. Similar in all respects, but the markings heavier. *Upperside, fore-wing:* the marginal series represented by a diffuse paler band. *Hind-wing:* the same represented by a wavy ill-defined band. The fringes more distinctly chequered.

Underside, both wings: the ground-colour clearer, yellow, not having such a grey appearance. *Fore-wing:* all spots heavier, larger and brighter. *Hind-wing:* the spots all better defined, by means of their darker edges, larger, but not brighter.

Length of fore-wing, ♂ 18 mm., ♀ 19 mm.

B.M. Type No. Rh. 069, ♂, 070, ♀, 22 viii. 1917. Solwezi, N.W. Rhodesia (*H. C. Dollman*).

"This species would seem to be on the wing only after the veldt fires; then, owing to its obscure smoky colour, and constant habit of settling on the bare soil or burned grass roots, it is very inconspicuous."

Some specimens show a very slight yet distinct reddish-brown tinge in the hind-wings below. The species is nearest to *A. orthrus* Trim., but readily separable from that by its larger size and the grey, not orange, colour of the underside of the fore-wings; the females, too, are devoid of orange markings on the upperside.

1 ♂, 3 ix. 1913, 1 ♀, 13 ix. 1913, Mumbwa; 2 ♂♂, 3 ♀♀, 22 viii. 1917, Solwezi (including type ♂♀).

HESPERIDÆ.

18. **Sarangesa neavei,** sp. nov.

(Plate VII, fig. 13.)

♂. *Upperside, both wings:* dark blackish-grey, finely irrorated with greyish; numerous minute pale brownish-grey spots; fringes uniformly grey, the distal half rather lighter, not chequered. *Fore-wing:* the arrangement of spots the same as in *Sarangesa astrigera* Butler, one distally in cell, one in area 11 above it, two each in areas 6, 7 and 8 all close together, one each in 4 and 5 beyond the others, one each in 2 and 3 very minute and towards the bases of the areas, in 1*b* two below these two and a further pair towards base; a marginal series of eight pale points. *Hind-wing:* an indistinct pair of spots at cell end and a series of five more distinct spots in a semicircle around them between them and costa, the series continued very indefinitely towards the inner margin on disc of wing; a series of marginal dots as in fore-wing, but incomplete.

Underside, both wings: uniformly smooth dark greyish-brown; the spots as above but much more distinct and whiter. *Fore-wing:* spots in area 7 absent; marginal dots confined to area 1*b*, the basal spots in this area much larger than above. *Hind-wing:* the spots resolve themselves into one in cell anteriorly just before origin of

vein 7, one basally in 1*c* below origin of vein 2, two discal and one marginal series; the inner discal series of six spots, a largish one in 7 above origin of vein 7, one each in 5, 4 and 3 very close to cell, a pair in 1*c*; the outer series of eight, one each in 7–2 and a pair in 1*c*, parallel to margins; marginal series of six in areas 1*b*, 1*c* (two) to 4; the base of wing and areas 1*a* and 1*b* with slight greyish scaling.

Palpi, head and thorax above, and body above and below of same colour as wings; palpi below yellowish-white, thorax the same, greyer posteriorly; 1st and 2nd pairs of legs inwardly paler, the extremities of all tarsal joints of paler or white. Antennae black, white ringed, the club broader, white-banded just beyond commencement.

Length of fore-wing, 11·5 mm.

B.M. Type No. Rh. 071, ♂, Yiafusa R., Lukanga Valley, N.W. Rhodesia, viii. 1915 (*H. C. Dollman*).

There is only this single specimen in the Dollman Coll., there are, however, four other male specimens in the B.M. from N.E. Rhodesia, collected by S. A. Neave. The species is of variable size, some being as large as *S. astrigera* Butler, to which it is closely related. It resembles the Indian species, *S. sati* de Nicé., very much in appearance.

19. **S. laelioides,** sp. nov.

(Plate VII, fig. 14.)

♂. *Upperside, both wings:* dark roughish grey-brown with darker shadowy markings. *Fore-wing:* the whole surface, but more particularly the base and hind margin, with faint brassy reflections, a minute white spot in anterior part of cell just below origin of vein 11, a similar spot towards base of area 3 and an oblique one below it in area 2, three small subapical spots, subquadrate, the lower one very slightly beyond the others, all hyaline; a darker transverse band, whose inner edge shades into the ground-colour, from costa to inner margin, and whose outer edge runs from costa just before end of vein 12, just within hyaline cell spot to posterior edge of cell, where it is sharply angled, thence to the hyaline spot in area 2, and thence to inner margin, but fading away on vein 1, outwardly bordered by a narrow parallel area sprinkled with grey scales; beyond this a large squarish darker costal area, reaching to subapical spots and posteriorly but indefinitely extending into cell so as to appear to fuse with the transverse band towards base of vein 3, but not actually doing so, and also fusing in the other direction with the cloudy submarginal band, about areas 3 and 4; beyond subapical spots, and touching them, a small triangular greyish patch; margin greyish with a fine dark grey line before fringes, which are white

at the apex, brown elsewhere. *Hind-wing:* without any metallic reflections; a sub-basal and two discal series of very indefinite shadowy darker spots, a marginal dark line, fringes dark brown.

Underside, fore-wing: as above, but of a smoother browner appearance, the markings, except hyaline spots, barely indicated, marginal area rather heavily sprinkled with long narrow grey and yellow scales. *Hind-wing:* as above, the markings even less clearly indicated, the whole surface, but especially the hind margin and inner margin, sprinkled with scales like the fore-wing.

Head, thorax, body, legs and palpi above matching the wings in colour; palpi below lighter. Antennae black, rather broadly white ringed, the club black, proximally whitish, the tip grey.

♀. Like the ♂, but with ground-colour slightly paler, so that the markings show up better; below the same as the ♂.

Length of fore-wing, ♂ 18 mm., ♀ 19 mm.

B.M. Type No. Rh. 072, ♂, Jan., and 073, ♀, Feb., 1917, Solwezi.

Also 5 ♂♂, 1 ♀, Solwezi, i.–iii. & ix. 1917. The species shows considerable variation in the number of the hyaline spots. All have the three subapical spots, but of the others any or all may be absent; no two specimens in the series are alike in this respect. The one dry-season specimen—a male taken in September—only differs from the others in being of a rather lighter shade of grey, so that the markings are rather more distinct, though still very obscure. It was thought at first that this might only be the wet-season form of *S. laelius* Mab., but preparations of the genitalia show it to be absolutely distinct. Although the arrangement of the markings is very similar to that species, the shape of the outer edge of the transverse band—when it is possible clearly to see this—readily separates this species from *S. laelius*.

20. **Sarangesa maxima** Neave.

Sarangesa maxima Neave, Proc. Zool. Soc. Lond., p. 70, 1910.

1 ♂, 2 vi. 1917, 1 ♂, 5 x. 1917, on the open plain by the Chifubwa River, Solwezi, Boma. Dry-season form.

"In life the orange underside is very striking." Neave records this as a forest insect.

The wet-season form of this species, of which there are two ♂♂ (Jan. 1917 and 27 x. 1917, Solwezi) in Dollman's collection, are so very different in appearance as to need a separate description.

(a) *S. maxima* f. *flava*, f. nov.

(Plate VI, fig. 6.)

♂. *Upperside, both wings :* dark brownish-black, chequered with large orange subquadrate spots; fringes blackish, chequered with pale yellowish. *Fore-wing :* basal third and area 1*a* lighter, greenish-brown; hyaline spots as in dry form, viz. : one in cell, a small one in area 3, and a larger below in 2, circular, and three subapical spots, the lower triangular, the middle one the smallest; a spot in cell before and below the hyaline cell spot, a similar one above this spot, on costa, one below in 1*b*, large, a large oblong spot at cell end halved by the black discocellulars into two almost square spots, all orange; beyond these, two series of similar orange spots, the inner of 8, the outer of 7 spots from costa to inner margin, the series converging in areas 4 and 5, so that the spots of the two series are almost fused in those areas. *Hind-wing :* a small spot in cell before origin of vein 7 and a large one at cell end; indications of similar but small spots in area 7 above origin of vein 7, in areas 2 and 3 right at their bases, and a larger, distinct one in 1*c* centrally; a discal and a marginal series of six and five spots respectively, the spots in area 4 touching, all squarish and orange.

Underside, fore-wing : completely orange yellow except for areas 1*a*, basal halves of 1*b*, 4 and 5, the areas immediately surrounding the hyaline spots, the veins, some costal shading chiefly before the subapical spots, and a submarginal obscure band of shading, all of which are black. *Hind-wing :* the same, with variously shaped, mostly squarish black spots arranged : two in cell, the distal one the larger and orange-centred; three in 1*c*, evenly spaced, the basal one very diffuse; a series of seven commencing with two in area 7 and extending in a semicircle to the distal spot in 1*c* (exclusive), the distal one in 7 the largest, the one in 3 minute; a cloudy marginal spot in 7.

Length of fore-wing, 16 mm.

B.M. type No. Rh. 189, ♂, 27 xi. 1917, Solwezi.

That this insect is the wet-season form of *S. maxima*—as suggested by Dollman—there seems no reason to doubt. The undersides are very similar and the arrangement of the markings coincides throughout. There is no difference visible in the genitalia.

21. **Eretis herewardi**, sp. nov.

(Plate VI, fig. 7.)

♂. *Upperside, both wings :* shiny dark grey-brown with obscure darker markings; fringes chequered with lighter grey rather diffusely. *Fore-wing :* seven hyaline spots, viz. : two in cell, one above the other, between origins of veins 3 and 11, very small, a very small one

at base of area 3 and a large oval one below it in area 2, three subapical spots in usual position, the lowest beyond the others; two round dots in 1*b* basally, a broad transverse band, broken up on costa, darkest against the hyaline spots in cell, broader but lighter thence to inner margin, a large squarish patch not reaching costa, bounded by the three subapical hyaline spots and reaching similar spot in area 3, two rather indefinite spots below hyaline spot in area 2, a straight cloudy band from apex to inner margin near outer angle, broadest below vein 4, and the whole of areas 1*a* and 12 all darker than the ground-colour; the marginal area lighter and shinier as to ground-colour. *Hind-wing:* some obscure darker markings basally hardly separated from a sub-basal transverse obscure band of darker spots; this latter followed by a similar broad discal band close to which, on its outer edge, there appears to run a series of black dots; a similar submarginal band of equal width except anteriorly, where it extends to the margin, equally ill-defined; marginal area rather lighter.

Underside, fore-wing: as above, but lighter; of the dark markings the most conspicuous are the distal pair of spots in 1*b* and that part of the submarginal band which is represented in areas 4 and 5 by two triangular spots, the other dark markings very obscure; immediately beyond and touching the hyaline cell spots is a lighter area with a faint reddish tinge. *Hind-wing:* much lighter than above, especially posteriorly; darker markings are: three indistinct square spots in area 7, a transverse line near cell end, one at cell end and one centrally in area 6, from which a wavy interrupted dark line, broadest in 4 and 5, extends to vein 1*b*; an oblong lighter, almost reddish patch from just within cell to the dark markings in area 4 and 5.

Palpi, head, thorax and abdomen above of same colour as wings. Palpi below grey, thorax, body and 2nd and 3rd pairs of legs matching the wing coloration; first pair of legs externally white. Antennae grey, white ringed, the club above black, below grey centrally, otherwise white.

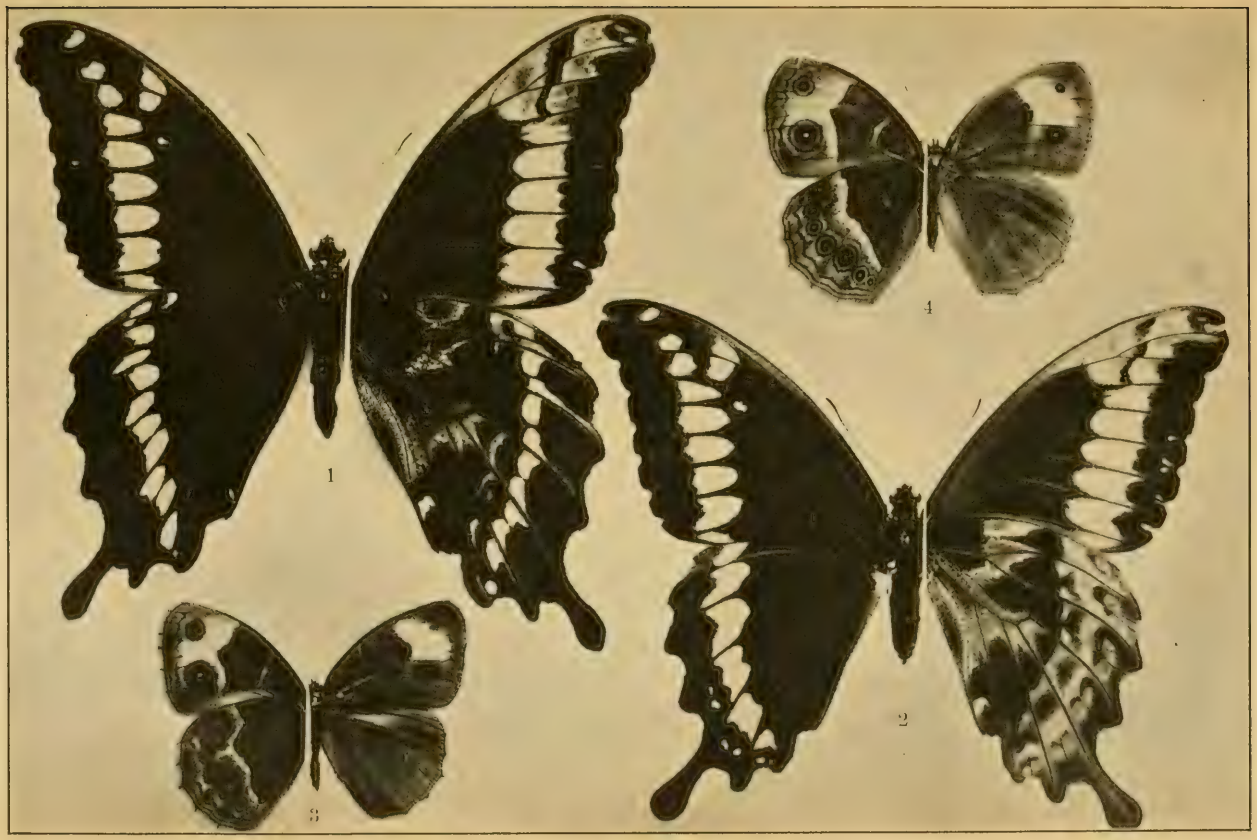
♀. Exactly like the male.

Length of fore-wing, ♂ and ♀ 15·5 mm.

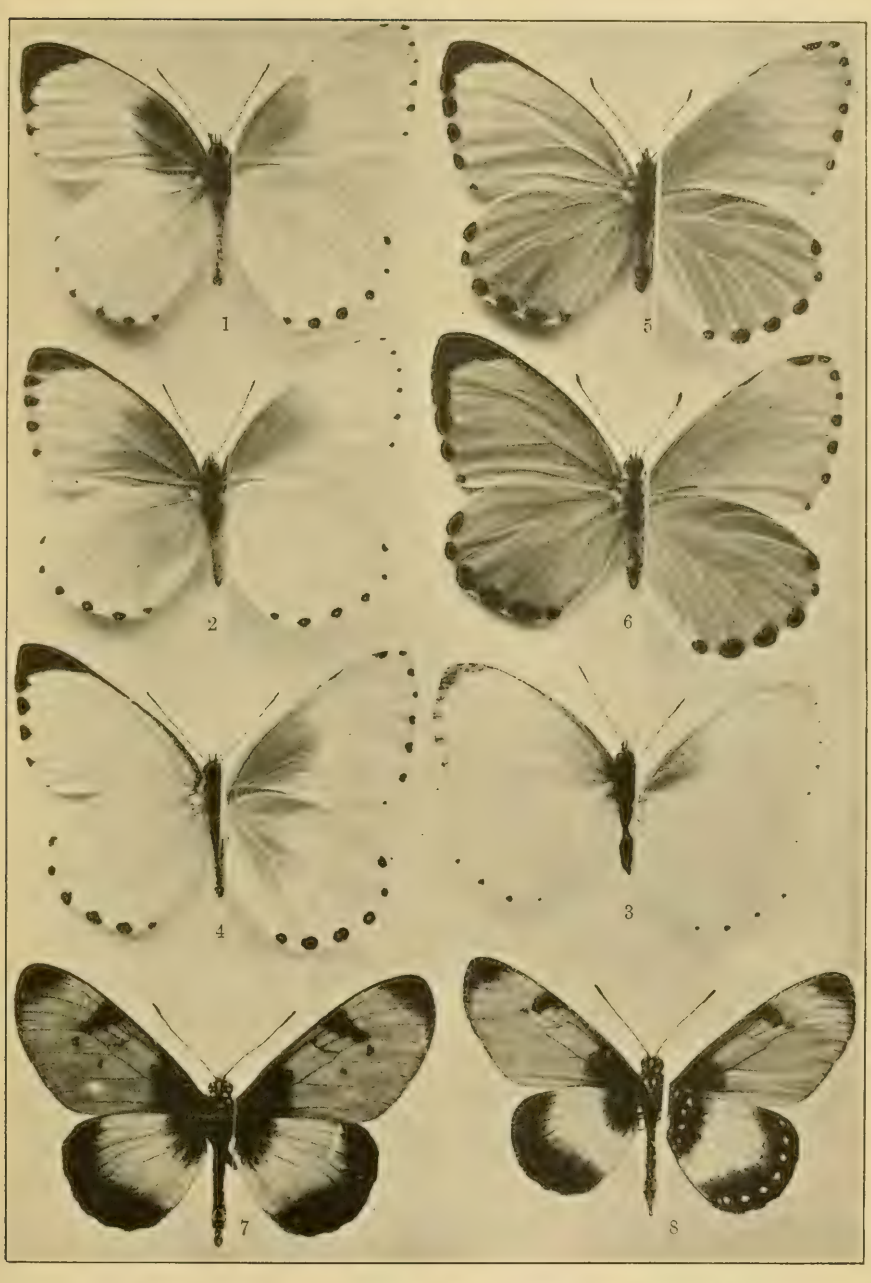
B.M. Types No. Rh. 074, ♂, and 075, ♀, Solwezi, bred 30 xii. 1917 and 11 i. 1918 respectively. In addition 10 ♂♂, 7 ♀♀ Dec.–Jan., Solwezi, all bred.

Of this species Dollman says: "Never caught on the wing. The larvae, which were found in numbers on a small herbaceous plant near the Solwezi River, are brown, with the head nearly black. They live in the usual Hesperid fashion in a spun-up leaf or leaves."

The species was also obtained on the Lualaba River and



BUTTERFLIES FROM NORTHERN RHODESIA.



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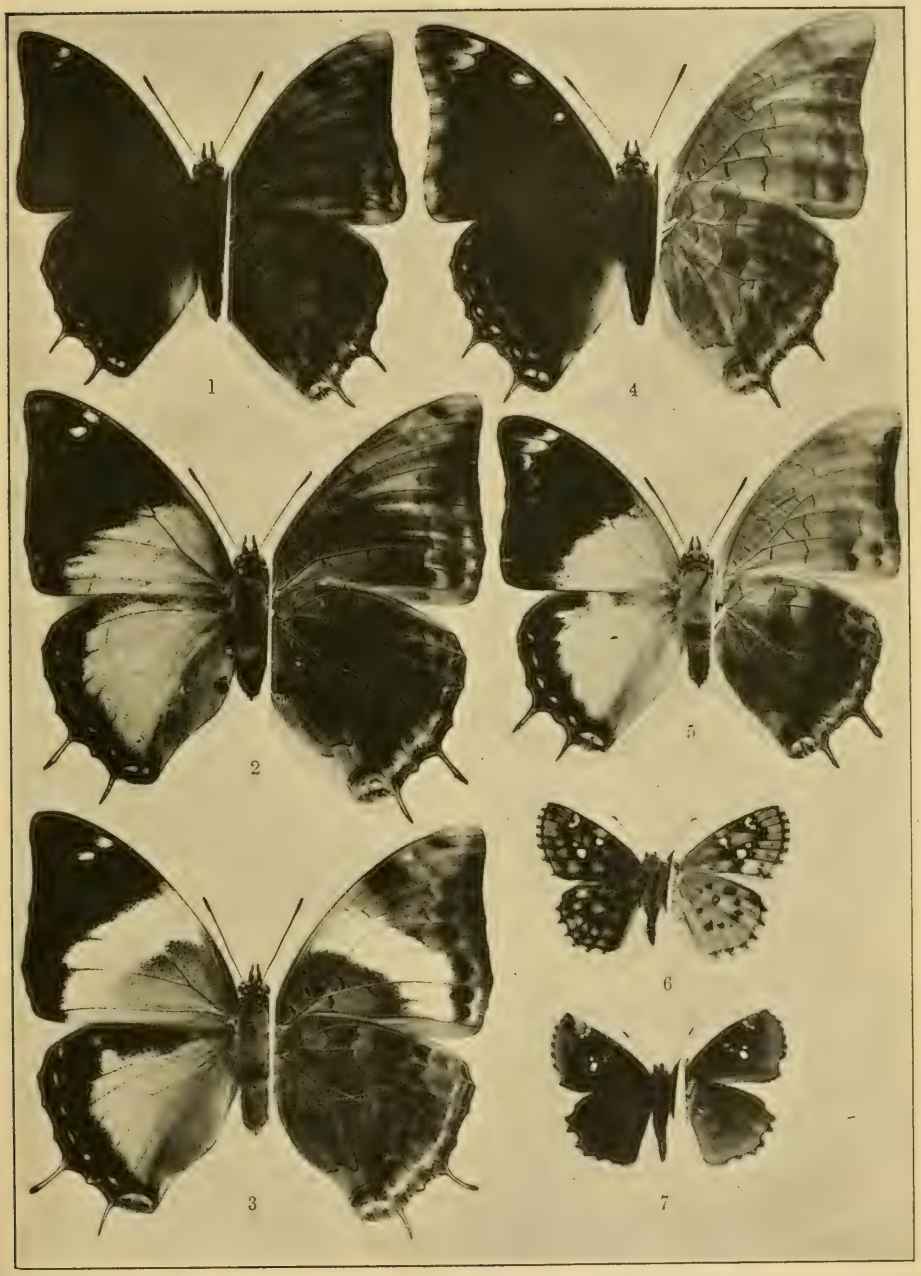

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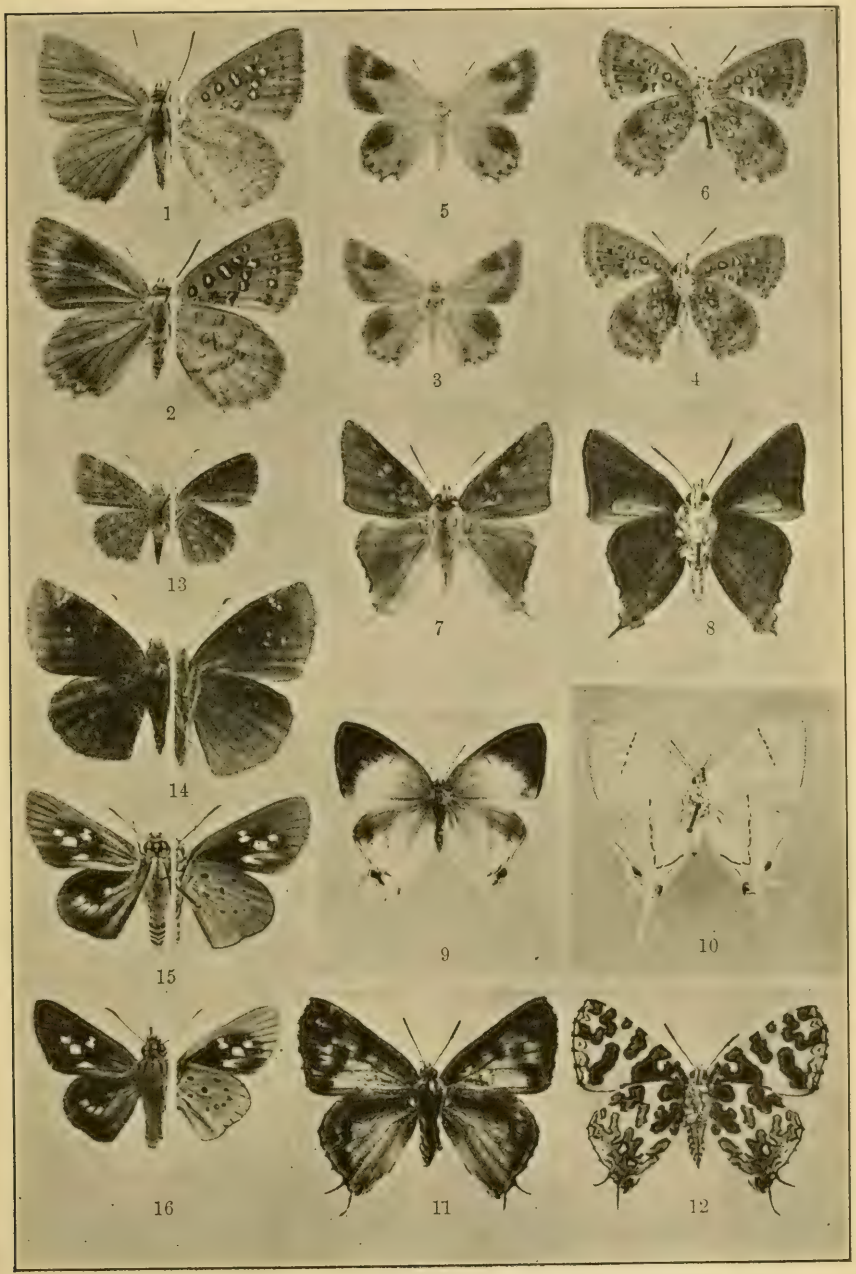

BUTTERFLIES FROM NORTHERN RHODESIA.

in Katanga by Neave. It is readily separable from the other species by its larger size and more conspicuous markings. It has a bronzy appearance which separates it readily from *E. djaelaelae*. It might perhaps be taken at first for a large form of *E. lugens*. Its genitalia, however, are totally unlike those of any of the other species in the genus, the chitinous structures which form the so-called "penis-funnel," through which the penis moves, in addition to furnishing upper and lower paired lateral projections, are produced ventrally to form a single long tapering chitinous process, which extends almost beyond the claspers and throughout is densely covered with short stiff spines.

22. **Parnara nyassae** Hew.

(Plate VII, figs. 15 and 16.)

13 ♂♂, 5 ♀♀, i–iv., Kashitu and Solwezi, showing considerable variation in the coloration of the underside. Hewitson's type of this species, a female, has the hind-wing and the apex of fore-wing below of a violet-grey, and thus agrees exactly with *roncilgonis* Plötz, as shown by copies of his unpublished plate No. 1380 in B.M. The majority of Dollman's specimens have this violet-grey replaced by yellow-ochre, and the costa and cell of hind-wing also marked with streaks of bright red; with this is usually correlated an increase in the yellow markings of the upperside, particularly between the veins in costal and apical region of fore-wing. So distinct is this form that Dollman regarded it as a distinct species. The two forms certainly occur together in spite of the apparently seasonal character of their differences, though their genitalia do not seem to warrant their separation except as forms of the same species. In this case the light form may be called **ennuari** f. nov. (B.M. Types No. 076, ♂, 077, ♀, Solwezi, iv. 1918). Intermediates occur, but are scarce, one having been described, as far as can be ascertained without reference to the type, by Karsch (B. E. Z., 38, p. 250, 1893) under the name of *cojo* Karsch.

B. netopha Hew., which is frequently confused with this species, is really easily to be separated, as it has all the spots on the underside of the hind-wing crowded together towards the centre—*nyassae* has them in a wide circle. It only occurs from W. Coast to Uganda, as shown by the series in B.M. Hewitson's type is a female from "W. Africa."

Explanation of Plates.

N.B.—The upper- and undersides have in all cases been taken from the same specimen, but, owing to an error, the undersides are all slightly enlarged, the uppersides being natural size.

EXPLANATION OF PLATE IV.

Fig. 1. *Papilio mackinnoni theodori*, nov., ♂, upper- and underside, p. 234.
2. *Papilio mackinnoni theodori*, nov., ♀, upper- and underside, p. 234.
3. *Mycalesis cooksoni* f. *latior*, nov., ♂, upper- and underside, p. 239.
4. *Mycalesis cooksoni* f. *latior*, nov., ♀, upper- and underside, p. 239.

EXPLANATION OF PLATE V.

Fig. 1. *Mylothris rüppellii rhodesiana*, nov., ♂, upper- and underside, p. 236.
2. *Mylothris rüppellii rhodesiana*, nov., ♀, upper- and underside, p. 236.
3. *Mylothris rüppellii kikuyuensis*, ♀ f. *kaffana*, nov., upper- and underside, p. 236.
4. *Mylothris dollmani*, nov., ♂, upper- and underside, p. 237.
5. „ „ „ ♀, „ „ „ p. 237.
6. „ „ ♀ f. *flavida*, nov., upper- and underside, p. 239.
7. *Acraea welwitschi lutea*, nov., ♂, upper- and underside, p. 244.
8. *Acraea welwitschi nivea*, nov., ♂, upper- and underside, p. 245.

EXPLANATION OF PLATE VI.

FIG. 1. *Charaxes etheocles* ♂ f. *cytila* Roths., upper- and underside, p. 242.
2. *Charaxes etheocles* ♀ f. *phaeus* Hew., upper- and underside, p. 242.
3. *Charaxes etheocles* ♀ f. *manica* Trim., upper- and underside, p. 242.
4. *Charaxes fulgurata* Auriv., ♂, upper- and underside, p. 242.
5. „ „ ♀ f. *mima*, nov., upper- and underside, p. 243.
6. *Sarangesa maxima* f. *flava*, nov., upper- and underside, p. 255.
7. *Eretis herewardi*, nov., ♂, upper- and underside, p. 255.

EXPLANATION OF PLATE VII.

FIG. 1. *Aloeides griseus*, nov., ♂, upper- and underside, p. 251.
2. „ „ „ ♀, „ „ „ p. 251.
3–4. *Aloeides molomo mumbuensis*, nov., ♂, upper- and underside, p. 250.
5–6. *Aloeides molomo mumbuensis*, nov., ♀, upper- and underside, p. 250.
7–8. *Aphnaeus affinis*, nov., ♂, upper- and underside, p. 249.
9–10. *Hypolycaena japhusa*, nov., ♀, upper- and underside, p. 246.
11–12. *Spindasis cynica*, nov., ♀, upper- and underside, p. 247.
13. *Sarangesa neavei*, nov., ♂, upper- and underside, p. 252.
14. „ *laelioides*, nov., ♂, upper- and underside, p. 253.
15. *Parnara nyassae* f. *ennuari*, nov., ♀, upper- and underside, p. 257.
16. *Parnara nyassae* f. *ennuari*, nov., ♂, upper- and underside, p. 257.

VII. *On some Australian* Chrysomelidae (Coleoptera) *in the British Museum.* By Arthur M. Lea, F.E.S.

[Read April 6th, 1921.]

Mr. Gilbert J. Arrow having sent for examination a few species of Australian Chrysomelidae belonging to the British Museum, a few notes on these, with descriptions of some of the new ones, are here given.

Ditropidus albohirsutus Baly (formerly *Elaphodes*).

A male of this species, from the Baly collection in the British Museum, and agreeing with the original description, is quite evidently a hairy *Ditropidus*, as the antennae are typical of that genus, instead of that of *Elaphodes*, to which it was referred by Baly. In appearance it is like a large specimen of *D. flavipes* Lea, from which it may be distinguished by its larger size, less polished elytra with more distinct punctures, wider scutellum and dark hind femora.

Ditropidus chapuisi Baly (formerly *Bucharis*).

A male of this species sent for examination by the British Museum is very close to *D. pubicollis* Chp., but has the eyes much closer together. Baly proposed the genus *Bucharis* for species having the tip of the scutellar lobe entire, instead of notched as in most species of *Ditropidus*, but the notch varies considerably in that genus, and is sometimes so feeble that it can only be seen when the prothorax is more or less detached, so that the lower surface of the lobe is visible; it is not a workable distinction, and I have no hesitation in referring the present species to *Ditropidus*.

Ditropidus hirticollis Baly.

A male from the British Museum, sent as this species, and agreeing well with the description, is close to *D. capricollis* Lea, and the elytral punctures and striae are almost identical, but the eyes are much closer together, less than half the width of the clypeus separating them, and the elytra are more narrowed posteriorly. The species occurs in South as well as Western Australia, as Mr. A. H. Elston has taken many specimens, including a pair *in cop.*, on the Murray River. The female differs from the male in being more robust, eyes more widely separated, legs shorter and abdomen foveate.

Ditropidus tarsatus Baly.

A female, sent as belonging to this species, from the British Museum, has the intercoxal process of the prosternum longer than wide, with its posterior end semicircularly emarginate and the tips acute; the hind angles of the prothorax also embrace the shoulders. It should, possibly, have been referred to *Prasonotus*. The species is a variable and widely distributed one, as there are two examples from Roebuck Bay (North-Western Australia) in the British Museum, one from Cue (Western Australia) and another from Parachilna (South Australia) in the South Australian Museum. These range in size from 3 to 4 mm., and have the postmedian spots on the elytra varying considerably in size and intensity (on the Parachilna specimen they are irregularly conjoined); parts of the under-surface are more or less deeply infuscated. The prothorax has very minute pubescence that could be easily overlooked and was not mentioned by Baly. In the male the front tibiae are much longer and thinner than the others, and the abdomen has a small and shallow subapical impression instead of a large fovea.

Ditropidus sculpturatus, sp. n.

♂. Black, in parts with a more or less conspicuous coppery or bronzy gloss, apical half of elytra (except suture) flavous, tibiae, tarsi and six basal joints of antennae more or less obscurely reddish or testaceous. Head between eyes and in front, prosternum, mesosternum, sides of metasternum and of abdomen, and the pygidium, with more or less dense silvery pubescence.

Head with small more or less concealed punctures, eyes large and almost touching. *Prothorax* strongly convex, the sides and base with dense and coarse punctures, elsewhere with sparse and very small ones. *Scutellum* small and transverse. *Elytra* short, sides conspicuously narrowed posteriorly, with conspicuous striae containing fairly large punctures throughout. Front *legs* slightly longer than hind ones. Length (♂, ♀), 2–2·25 mm.

♀. Differs in being slightly larger, head with more distinct punctures (due to sparser pubescence), abdomen with a large, round, deep apical fovea, and front legs no longer than hind ones.

Hab. North-Western Australia: Baudin Island and Baudin Point. Types in British Museum.

A small, compact, strongly sculptured species not very close to any other known to me. The eyes of the male

are almost touching, the pubescence between them looking like a thin line of silver: the labrum is blackish and shining, with its sides obscurely reddish; the pale parts of the elytra appear like two large almost conjoined spots; the coarse punctures on the prothorax belong to sharply defined areas, they are sparser about the scutellar lobe than elsewhere, the lobe itself appears to be acute and entire, but when lifted above the scutellum is seen to be slightly notched. The species would probably have been referred to *Bucharis* by Baly.

Ditropidus punctatostriatus, sp. n.

♀. Coppery, under-surface black with a bluish or coppery gloss in places, labrum, antennae, palpi, legs (claws black), apex of abdomen and of pygidium flavous. Head, under-surface and pygidium with moderately dense white pubescence.

Head shagreened, becoming rather coarsely but rugosely punctured in front, with a wide and shallow median line; eyes large and rather widely separated. *Prothorax* strongly convex, densely and finely strigose, except on a comparatively small medio-basal space. *Elytra* about as long as the basal width, somewhat narrowed posteriorly, with conspicuous striae containing large punctures throughout. *Abdomen* with a large, round, deep apical fovea. Length, 2·5 mm.

Hab. North-Western Australia: Baudin Point. Type in British Museum.

The shagreened head, densely striated prothorax and strongly sculptured elytra render this species a very distinct one, although the colours are much as on many others; it would probably have been referred to *Bucharis* by Baly, as the scutellar lobe appears from above to be acute and entire; from behind, however, its lower edge is seen to be notched. The antennae are rather longer than is usual in *Ditropidus*, but shorter than in *Elaphodes;* of the three specimens under examination one has them entirely pale, another has the tip only infuscated, and the other has the five joints of the club lightly infuscated on the upper surface. The strigosities of the prothorax, although fine, are quite distinct, the space from which they are absent is sharply defined and occupies about one-third of the surface in width and one-half in length; there are some small punctures on its front portion and rather strong ones along the base.

Ditropidus inconspicuus, sp. n.

♂. Black, upper-surface with a slight bronzy gloss; basal half of antennae testaceous.

Head shagreened and with small punctures, becoming distinct in front; eyes widely separated. *Prothorax* about thrice as wide as the median length, side strongly rounded in front; scutellar lobe distinctly notched, punctures rather dense, but small and not very sharply defined. *Scutellum* small, more than twice as long as wide. *Elytra* with outlines gently rounded and continuous with those of prothorax, with inconspicuous rows of small punctures, but the sides with distinct striae, interstices with minute punctures and faintly rugulose. Basal joint of front tarsi rather large. Length (♂, ♀), 1·75–2 mm.

♀. Differs in being rather more robust, antennae and legs somewhat shorter, basal joint of front tarsi smaller and abdomen with a large, round, deep apical fovea.

Hab. New South Wales: Sydney (*C. Darwin*). Types in British Museum.

A small briefly-elliptic species with a thin scutellum much as in *D. scutellaris* Lea, but differs from that species in being smaller, prothorax with much smaller and less sharply defined punctures, lateral striae of elytra less deep, head with denser punctures, its median line less conspicuous, labrum darker, etc. The head and under-surface are pubescent, but very sparsely and inconspicuously so.

Ocnida.

The original diagnosis of *Ocnus* of Clark (subsequently altered to *Ocnida* by Lefevre) is very unsatisfactory; Chapuis and Blackburn could not place it, but the latter evidently thought it might be a valid genus, as Baly had referred a second species to it. By the courtesy of Mr. Arrow I have seen authenticated specimens of both species (*viridis* and *pallida*), the former from Baly's collection and compared with the type, the latter marked "Type," but evidently a cotype; but I cannot regard the two species as congeneric, or even as belonging to closely allied genera.

Clark described the head of *viridis* as "haud verticale, penitus porrectum," and said the legs were as in *Edusa*, in comparing with which he also spoke of "its more porrect head." The differences he mentioned as separating it from *Edusa* are all worthless, the head (except for a slight

convexity) is normally vertical,* some species of *Edusa* are quite as parallel, as thin and elongate, and many have the labrum quite as deeply emarginate. The legs also are certainly not as in any species of *Edusa* in the South Australian Museum, more nearly resembling those of several species of *Colaspoides* and of *Geloptera*. The specimen before me is a male, its femora are stout and edentate, hind tibiae dilated to apex, notched at the lower apex, and with a long apical bristle, basal joint of four front tarsi strongly inflated and of the hind ones elongate, and claws with a wide basal appendix. The fourth segment of the abdomen is as long as the second and third combined, the fifth is transversely impressed across the middle, with its apex incurved and elevated. The upper surface is clothed with short and rather sparse but quite distinct pubescence, longer at sides and base of prothorax than on head and elytra, on parts of the under-surface the pubescence is fairly dense and on the abdomen there are some rather long straggling hairs. The head and prothorax are shagreened. I consider the genus (on account of the sexual features of the abdomen and legs) as distinctly closer to *Colaspoides* than to *Edusa;* and although not a sharply defined one, quite as distinct as many others of the sub-family. *O. pallida* is a *Megasceloides*.

Megasceloides.

The original diagnosis of this genus † was placed between descriptions of species of *Macrolema* and *Microgonus*, and the genus was compared with *Megascelis*. There is no doubt therefore but that Jacoby considered it as not belonging to the *Eumolpides;* nevertheless in treating of the *Criocerides* (23 - 1904) and *Megascelides* (32 - 1905) in Wytsman's "Genera Insectorum," he included it in neither. Blackburn, in referring a second species to the genus, said he had doubtfully regarded it as belonging to the *Megascelides*. *M. pallidus* of Jacoby was identified by Blackburn as a species from Western Australia that appears to me to agree well with the original description; but this species is identical with one sent for examination

* Accidental causes and the manipulation used to "set" parts of the head must often result in its being somewhat out of its proper position.

† Ann. Soc. Ent. Belge, xlii, p. 351.

by Mr. Arrow as *Ocnus pallidus* of Baly. I believe its position to be fairly close to *Edusa*; its pygidium (normally almost or quite concealed) has the deep median furrow that appears to be invariably present in the *Eumolpides*. *Terillus squamosus* Baly, also belongs to the genus, and probably *T. perplexus* Baly, and *duboulayi* Baly. Those known to me may be thus tabulated—

Elytra densely clothed.
  Elytra with long erect hairs in addition to depressed clothing. *squamosus* Baly.
  Elytra without long erect hairs . . . . *arrowi* Lea
Elytra glabrous (the margins sometimes excepted).
  Elytra with sides and suture deeply infuscated. *circumcinctus* Blackb.
  Elytra nowhere deeply infuscated . . . *pallidus* Baly.

Megasceloides pallidus Baly (formerly *Ocnus*), *M. pallidus*, Jac.

Both Baly's and Jacoby's types were from Nichol Bay in North-Western Australia.

Megasceloides squamosus Baly (formerly *Terillus*).

A cotype of this species, sent for examination, is probably a male, the basal joint of each of its four front tarsi is larger than those of the hind ones, but not very conspicuously inflated; the fourth segment of its abdomen is the length of the third, but much shorter than the fifth, it is gently depressed in the middle, with the apex feebly incurved, the fifth has three shallow depressions towards the apex, the middle one of which is open posteriorly so that the apex is distinctly notched. The antennae are not inflated in the middle, but this character appears to be a sexual and specific, rather than a generic one. The prothorax was described as being "impressed, but not very closely, with deep round punctures," these were also described as subremote; on the cotype they are decidedly dense at the sides, but sparser in the middle, although even for these the expression "subremote" would not be correct; possibly the character is variable. The tibiae are all somewhat produced at the outer apex, but the four hind ones are not distinctly notched near the same.

Megasceloides circumcinctus Blackb.

Recorded simply as from Western Australia; there are two specimens from Cue in the South Australian Museum.

Tomyris dumbrelli Lea.

Four females from Sydney (*C. Darwin*) evidently belong to this species; they are slightly stouter than the males; the antennae are shorter and more of the joints are infuscated; the upper surface is entirely brassy or bronzy, but not highly polished, and parts of the sterna have a vague greenish gloss.

Edusa chlorion Lea.

A specimen of this species was taken at King George's Sound by Darwin.

Rhyparida cyrtops, sp. n.

Black, parts of muzzle, of elytra, of legs and of antennae more or less reddish or castaneous.

Head strongly convex at base, with dense punctures in front and at base; eyes prominent and widely separated. *Prothorax* about once and one-half as wide as long, sides strongly rounded, front angles armed; punctures dense and rather coarse on sides, becoming sparser and smaller, but quite distinct in middle. *Elytra* much wider than prothorax, with rows of rather large punctures, becoming much smaller posteriorly and almost vanishing about apex. Flanks of *prosternum* closely striated throughout. Length, 3·5–3·75 mm.

Hab. Western Australia (Baly collection, from F. du Boulay), Nichol Bay (Fry collection). Type in British Museum.

The three specimens before me all differ somewhat in colour: on the type the elytra are castaneous, except for the suture, margins, and a subtriangular space on each side at the basal third, its tibiae and basal third of antennae are more or less obscurely reddish; the second specimen has the elytra black except for a small flavous spot on each shoulder and two large subapical spots; the third specimen may be immature, its elytra are as on the type, except that the markings are less sharply defined, its head and prothorax are partly pale and legs entirely so. In general appearance it is close to some forms of *R. apicalis* Jac.; structurally, especially as regards the eyes, it is close to

R. flavipennis Lea, but the armed front angles of the prothorax are distinctive. The clypeal suture is rather ill-defined, but as there is a faint depression at its position, and there are some distinct punctures close behind this and some more about the base, it might, in my table of the genus, be referred to *Ak* and associated with *R. bimaculicollis* Lea, to which it is not at all close; but regarding it as belonging to *kk* it would be associated with *R. copei* Lea, which has considerably larger eyes, pale prothorax, etc. The two may be thus distinguished.

Distance between eyes less than transverse diameter of an eye. *R. copei* Lea.

Distance more than transverse diameter of an eye . *R. cyrtops* Lea.

VIII. *Types of* Heteromera *described by F. Walker now in the British Museum.* By K. G. Blair.

[Read April 6th, 1921.]

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The Heteromera described by Francis Walker are contained in three papers, viz. :—

I. "Characters of some apparently undescribed Ceylon Insects," Ann. and Mag. Nat. Hist. (3) ii–iv, 1858–1859.

II. "The Naturalist in British Columbia," by J. K. Lord, vol. ii, App. 1866, pp. 326–331.

III. "List of Coleoptera collected by J. K. Lord in Egypt," 1871.

The material which formed the basis of the last-named paper was sent to the School of Medicine at Cairo, but so long ago as 1884, the collection had been entirely destroyed by *Anthrenus*. A list of the species, with more precise localities taken from the labels that alone remained attached to the pins, was published by Dr. W. Innes Bey in the Bulletin of the Entomological Society of Egypt, 1911, 3rd fasc., pp. 97–115.

I

The types of the Ceylon insects have long been in the British Museum collection, most of them having been presented by Dr. Templeton and bearing the register no. 59.106; others which were in the collection of the Entomological Society were later presented by that body to the Museum, and bear the register no. 63.52.

The descriptions are merely brief Latin diagnoses, rarely more than two or three lines long, and the species are frequently assigned to genera and even families with which they have no connection. Not unnaturally therefore they remain in many cases as mere catalogue names quite unrecognised by modern workers.

The species are here taken in the generic order adopted by the authors of the respective parts of Junk's "Coleopterorum Catalogus," the names of the genera to which they were assigned by Walker being given in brackets.

Synonymy that appears in this Catalogue is not quoted again here.

In cases where Walker's name is superseded, the name that stands is printed in small capitals.

Fam. TENEBRIONIDAE.

1. **Pseudoblaps clavipes (Zophobas)**, op. cit. ii, 283.

P. DISPAR Herbst. (= *atrata* auctt., *nec.* F.).
Notocorax nigrita Muls.

The synonymy of this insect has already been the cause of considerable confusion. It is the *Helops nigrita* F., of the Syst. Eleuth. I, 1801, p. 160, the type of which is at Copenhagen, and was accepted by Mulsant as the type of *Notocorax nigrita*, but the *Helops nigrita* of Fabricius' earlier works is, as already shown by me,* a true *Zophobas* (*Z. atratus* F. = *Z. morio* Geb. Cat., *nec* F.).

2. **Gonocephalum bilineatum (Opatrum)**, op. cit. ii, 284.

G. kamtschaticum Mots.
G. orarium Lewis.

A widely distributed Oriental species that has been generally recognised in collections. It is probably also identical with *G. seriatum* Boisd., from the Pacific islands, in which case this latter name has priority.

3. **G. contrahens (Opatrum)**, loc. cit.

G. DEPRESSUM F.

A common Indo-Malayan species.

4. **G. planatum (Opatrum)**, loc. cit.

Closely allied to *G. moluccanum* Blanch., the ♂ of both species having a tooth on the underside of the anterior tibiae. In *G. planatum* this tooth is but little beyond the middle of the tibia, while in *G. moluccanum* it is placed at a distance from the apex, about equal to the oblique apical width of the tibia.

G. planatum is the Oriental species considered by Miedel to be *G. arenarium* F., by which name it is

* Ann. and Mag. Nat. Hist. (8) xiii, 1914, p. 487.

frequently known in collections. As I have shown elsewhere,* *G. arenarium* F., is in reality a S. African species.

5. **Bradymerus serricollis (Opatrum),** loc. cit.

Several specimens from different collections in the British Museum, but none from outside Ceylon. It is very similar to *B. denticeps* Geb., from Borneo, the Malay Peninsula and Tonkin, but has the sides of the prothorax more strongly arcuate, with a very much wider explanate border.

6. **Byrsax horridus (Asida),** op. cit. ii, 284.

B. CORNUTUS F.

Not identical with *B. horridus* Oliv. (= *tuberculifer* Mots.), as given in the Catalogues. The two species, both found in Ceylon, are very similar, but *B. cornutus* (= *horridus* Walk.) is smaller, with the margins of thorax and elytra much more acutely dentate, the former with a deep round emargination on each side at the base.

7. **Dysantes biluna (Toxicum),** loc. cit.

Also from Ceylon in the Lewis and Bates collections. Two further specimens in the latter are labelled "Neilgiris."

8. **Platydema velutinum (Diaperis),** op. cit. ii, 283.

P. tarsale Chevr.

Received also from the Andaman Islands (*Roepstorff*).

The species is closely allied to *P. famosum* Lewis, from Japan, but the ♂ (type) has a transverse row of four small indistinct elevations between the eyes, the outer ones almost contiguous with the eyes. There is also a similar elevation or tubercle in the middle of the front margin of the clypeus. *P. tarsale* Chevr., appears *ex descr.* to be identical.

9. **Platydema detersum (Crypticus),** op. cit. ii, 284.

P. malaccum Mars.
P. laticorne Fairm.
P. annamitum Fairm.

A widely distributed Oriental species. The synonymy of the last three species has already been published by

* Ann. and Mag. Nat. Hist. (8) xiii, 1914, p. 485.

Gebien. *Ceropria valga* Pasc., from Queensland, is almost identical, but has the thorax somewhat less convex, the sides a little less arcuate, etc. *P. umbratum* Mars., from Japan, is larger, and the ♂ has the first joint of the anterior tarsi strongly incrassate. All these species have the intermediate tibiae in the ♂ strongly, and the posterior tibiae less strongly, bent inwards about the middle.

10. **Platydema subfascia (Alphitophagus),** loc. cit.

Another well-known and widely distributed Oriental species, belonging to the group with asymmetrical cephalic horns, that on the right being well developed and hairy, while that on the left is abortive and naked.

11. **Derispia interrumpens (Coccinella),** op. cit. iv, 219.

Apparently confined to Ceylon.

Walker's description of the elytral markings, "*elytris vittis tribus bisinterruptis nigris*," is not sufficient for recognition. The suture is narrowly margined with black almost to the apex, and there is also a narrow black streak about the middle of the lateral margin; in some specimens this is continued to form a narrow lateral border. The three black vittae on the disc are about equidistant from one another, and consist of series of black spots or dashes, a roundish spot near the apex being common to all three series, while a similar spot at the base is common to the two dorsal series. The outer basal spot is more elongate, and the two intermediate spots of each series, which fall into two transverse rows of three, are still more elongate. The spots vary a little in size, with a tendency in the outer series to become confluent.

12. **D. quinqueplaga (Coccinella),** loc. cit.

Allied to the above but with a different elytral pattern. This consists of a narrow black sutural border confluent at the apex with an ovate black spot occupying the external half of the apex. On the disc of each is a large irregular black patch which varies considerably in size, and is sometimes completely wanting. In no specimen that I have seen does it attain any margin of the elytra or become confluent with the sutural or apical markings.

13. **Leiochrodes glabrata (Lycoperdina)**, loc. cit.

Fulvous, with the last seven joints of the antennae fuscous. Head not strongly transverse, the distance between the antennal bases being little more than that from the line joining them to the middle of the front of the clypeus. Antennae slender, 3rd joint not so long as 1st, 5th to 10th slightly longer than wide, strongly incrassate, more than twice as wide as 2nd to 4th. Thorax transverse, its width across the posterior angles about twice as long as its median length. Elytra with a sharply defined marginal sulcus which is continuous with a narrow basal border.

Length 3½ mm.

In the shape of the head and comparatively slender antennae this species agrees with *L.* (*Leiochrota*) *varicolor* Westw. From *L. uniformis* Westw., it differs in the antennae having joints 5-11 notably thicker than the preceding joints, and the apical joint black instead of rufo-fulvous.

14. **Uloma scita**, op. cit. ii, 284.

? *U. picicornis* Fairm.

The head in the ♂ has the clypeus and two oblique areas between and rather in front of the eyes elevated, the surface smooth, somewhat opaque and almost devoid of punctures, while the depressed trifurcate area between them is nitid and distinctly though irregularly punctate. The antennae are simple, the mentum cordate with a median depression in front.

U. scita is probably identical with the Malayan species that I take to be *U. picicornis* Fairm. The latter, however, has a line of about four well-developed teeth along the underside of the anterior tibiae of the ♂, which in *U. scita* are scarcely indicated.

15. **Uloma retenta (Tenebrio)**, op. cit. ii, 283.

U. POLITA Wied.
Eutochia latipes Fairm.

The type is a ♀, but the species is a common one in Ceylon and throughout the Indo-Malay region. Specimens from Mauritius that I identify with *Eutochia latipes* Fairm., are apparently identical.

16. **Alphitobius longipennis (Crypticus),** op. cit. ii, 284.
17. **Alphitobius rufipes (Phaleria),** loc. cit.

A. DIAPERINUS Panz.

It is possible that there has at some time been an error in labelling, otherwise it is difficult to understand how Walker could describe next to one another two individuals, so obviously of the same species, not only as different species, but in different genera. Yet each type is labelled in Walker's handwriting.

18. **Encyalesthus impressus (Upis),** op. cit. ii, 283.

Is correctly placed by Gebien in *Encyalesthus*. It most resembles *E. sinensis* Hope (= *foveolatus* Mars.), but is larger, has the thorax only feebly transverse and the anterior and intermediate tibiae in the ♂ thickened within just beyond the middle.

It appears to be confined to Ceylon.

19. **Anthracias oppugnans** Walk. **(Toxicum),** op. cit. ii, 284.

A. CURVICORNIS Chevr.

The Catalogues indicate considerable confusion in the synonymy of this and allied species. *A.* (*Toxicum*) *curvicornis* Chevr., a Ceylon species, is placed as a synonym of *A.* (*Toxicum*) *taurus* F., an African species. *A. gazella* F., from "India Orientali," is also placed as a synonym of the same.

I have not seen the type of *A. gazella*, but have no hesitation in identifying it with the Indo-Malayan species usually known as *A. elongatus* Schauf., with which *A. sumatrensis* Fairm., must be closely allied, if not identical.

A. curvicornis Chevr. (*oppugnans* Walk.) is very similar and probably only a form of the same species. The cephalic horns of the ♂ are usually much longer and more strongly curved, and the prothorax, even in poorly developed ♂♂, is more quadrate, the sides almost parallel until close behind the anterior angles, whereas in *A. gazella* F., they are feebly convergent almost from the base.

A. curvicornis appears to be peculiar to Ceylon and S. India.

20. **Camarimena variabilis (Strongylium)**, op. cit. ii, 285.

Apparently correctly recognised by Mäklin. The type is a large coppery individual. It was made the type of Pascoe's genus *Sinopium*.

21. **Camarimena laeviuscula (Strongylium)**, loc. cit.

Was also apparently correctly identified by Mäklin.

N.B.—*Strongylium parabolica* Walk., is not a *Camarimena*, as thought by Mäklin, but a true *Strongylium* (see below).

C. parabolica Mäkl. (*nec* Walk. = C. OVICAUDA Mots., *ex descr.*) is very like *C. variabilis*, but differs in the punctures of the thorax and the foveate punctures in the basal half of the elytral striae being very much finer.

22. **Osdara picipes**, loc. cit.

There are three specimens in Walker's series belonging to two distinct species, but only one is labelled in Walker's handwriting. As this agrees much better with the description than does the second species, it must be taken as the type, though the other is very much the commoner and is usually the species so named in collections. Both species have the elytral granules simple, nodular, and of very diverse sizes, black on a reddish ground; but in the type (♀) the thorax is about 1½ times as wide as long, the sides strongly sinuate and emarginate about the middle, markedly more prominent behind the emargination than in front of it. The disc is subnitid, not pubescent, with small scattered granules. In the ♂ the anterior and intermediate tibiae are produced and dentiform inwardly at the extreme apex.

The second species, *O. walkeri*, sp. n., is very similar, but has the thorax twice as wide as long, the sides feebly sinuate in the middle and not more prominent behind than before the middle, and the disc distinctly punctate and pubescent throughout, with the surface irregularly impressed, and a distinct median longitudinal impression bounded laterally by an elevation before the base. In the ♂ the anterior and intermediate tibiae are produced inwards at the apex, but much less sharply than in *O. picipes*.

23. **Osdara solida** Walk. (**Zophobas ?**), op. cit. ii, 283.

Does not appear to have been recognised by subsequent writers; the type (♂) remains unique in the British

Museum. Rather more slender than the corresponding sex of the last two species, the elytra scarcely wider than the thorax. The latter is about 1½ times as wide as long, the sides feebly sinuate in the middle, the disc subnitid, distinctly punctured throughout, but not so closely as in *O. walkeri*, and less uneven, with short sparse hairs not readily seen unless viewed obliquely. The seriate punctures of the elytra are very irregular, so that the series are difficult to follow, the granules simple and more or less regular in size and much less sharply prominent. They are arranged in indistinct longitudinal series with a tendency to collect together into groups, and are not markedly different in colour from the general dark background. The anterior and intermediate tibiae have a prominent tooth on the inner side *before* the apex.

A similar sexual character is found in *O. laevicollis* Pasc., but this species is much wider, and has the elytral intervals much more regular, the granules small but combined into little compact groups well separated from one another.

The following key may be useful for the identification of these and two hitherto undescribed species, all from Ceylon.*

1. (6) Elytral granules simple, not markedly grouped.
2. (5) Elytral granules nodular, of very diverse sizes.
3. (4) Thorax 1½ times as wide as long, median area nearly smooth and naked, without basal prominences . . *picipes* Walk.
4. (3) Thorax twice as wide as long, punctured and pubescent, with a pair of basal prominences enclosing a depression. *walkeri* sp. n.
5. (2) Elytral granules not very uneven in size, not nodular. *solida* Walk.
6. (1) Elytral granules collected into compact groups, at least on the alternate (2nd, 4th, etc.) intervals.
7. (10) Pubescence short and sparse, not concealing the derm; thorax and elytra separately convex; sexual characters as in *O. solida*.
8. (9) Thorax nitid, scarcely punctate or pubescent in middle, sides not sinuate before anterior angles *laevicollis* Pasc.
9. (8) Thorax distinctly punctate and shortly pubescent throughout, sides strongly sinuate before anterior angles. Length 7–8 mm. . . . . *lewisi* sp. n.

* *O. granosa* All., from S. India is unknown to me.

10. (7) Body covered with subdecumbent fulvous pubescence; thorax scarcely convex longitudinally, elytra strongly gibbous, very uneven, with granule-bearing prominences, those of 4th interval being the largest. Length 7 mm.
gibbosa sp. n.

24. **Hoplobrachium ebeninum (Helops)**, op. cit. ii, 285.

H. DENTIPES F.
H. asperipenne Fairm.

The type of *H. dentipes* F., is also in the British Museum, and this species is identical with *H. ebeninum* Walk. The Museum also possesses a specimen purporting to come from Mauritius that is probably correctly identified as *H. asperipenne* Fairm., from Madagascar, with the description and figure of which it agrees well. *H. dentipes* appears to be common in Ceylon and S. India, but the record from Madagascar is possibly erroneous or accidental. The locality "Mauritius" on the British Museum specimen is quite unreliable, other insects received with it undoubtedly originating from S. Africa and also from Ceylon.

25. **Spinamarygmus chrysomeloides (Amarygmus)**, op. cit. ii, 285.

There is no specimen bearing this name in the British Museum, but one without a name bearing the same register number (59.106) agrees fairly well with the description and is assumed to be the type of this species.

In the Hope collection at Oxford a specimen of *Ceropria induta* Wied., is labelled *A. chrysomeloides*, but the description does not fit this.

The presumed type, a ♀, has the anterior femora sharply dentate beyond the middle. The elytra are finely seriate-punctate, the intervals flat.

The ♂ has the intermediate tibiae bent about the middle, the anterior tibiae slightly so.

I have not been able to identify *S. indicus* Pic., the type of the genus, but *Amarygmus alienus* Pasc., must certainly come within the genus. From this species *S. chrysomeloides* differs in its very much smaller size and in having the anterior tibiae in the ♂ only slightly bent. In *S. alienus* they are very strongly so.

26. **Strongylium parabolicum,** op. cit. ii, 285.

S. bifoveolatum Mäkl.

Walker's species was not recognised by Mäklin, who, misled doubtless by its being placed by Walker between two species of *Camarimena*, assumed that it also should be placed in the latter genus.

27. **Strongylium elegans (Allecula),** op. cit. ii, 285.

Type unique in British Museum.

Eyes large, almost contiguous for some distance. Antennae (defective) very slender, joints 3–7 elongate, successively shorter, each becoming gradually thicker from base to apex, 7th joint about four times as long as its apical width. Thorax feebly transverse, sides sinuate, widest just before the middle, lateral carinae obsolete; apex truncate, anterior angles obsolete, base feebly bisinuate; disc convex, rugose punctate without marked impressions. Elytra $\frac{1}{3}$ wider than thorax, subcylindrical, striae coarsely and closely punctate, punctures squarish, each with a small tubercle in the middle of the sides; alternate (3rd, 5th and 7th) interstices wider than the rest, the suture and the 4th and 6th intervals infuscate. Legs slender, hind tarsi nearly as long as their tibiae, hind femora scarcely reaching penultimate abdominal segment.

The elytral sculpture is very similar to that of *S. clathratum* Mäkl., but the whole insect is more slender, especially the antennae and legs; the lateral carina of the thorax is wanting, eyes larger and closer together.

N.B.—Two insects placed by Walker in the family Diaperidae (op. cit. iii. p. 259) are determined by Mr. G. J. Arrow as follows :—

Tritoma BIFACIES = *Strongylus* (*Chilocorus*) *opponens* Walk. (fam. Nitidulidae).

T. praeposita = *Amblyopus* CINCTIPENNIS Lac. (fam. Erotylidae).

Fam. CISTELIDAE.

28. **Allecula fusiformis,** op. cit. ii, 285.

This and the following species are closely allied, but the accompanying additional details may help to identify them.

Antennae slender, filiform, fulvous, joints 3 and 4 subequal, prothorax widest at base, thence feebly narrowed to anterior angles, feebly convex across base, disc closely and finely punctate, somewhat less closely in anterior part. Elytral striae strongly and closely punctate, intervals rather finely and sparsely punctate, feebly and asymmetrically convex, the highest point being close to the outer stria. Legs fulvous, the femora blackish towards the apex.

♂. aedeagus pointed to apex. (Type ♀.)

29. **Allecula flavifemur,** op. cit. iii, 259.

Antennae slender, filiform, fuscous, reddish towards apex, joints 3 and 4 subequal, markedly stouter than the following. Thorax widest about the middle, thence feebly contracted towards base, more strongly so towards apex, moderately strongly convex across base; disc densely and strongly punctate, scarcely less densely towards apex. Elytral striae closely and strongly punctate, intervals evenly convex, moderately densely and finely punctate. Femora flavous, tibiae and tarsi blackish.

♂. aedeagus knobbed at apex. (Type ♂ with apex of abdomen wanting.)

Very near what I take to be *A. punctatella* Fairm., but darker, with the thorax more densely and coarsely punctate, more attenuate towards apex.

30. **Cistelopsis falsifica (Cistela),** op. cit. iii, 259.

Elongate oval, rufo-fulvous, head short and broad, eyes transverse moderately approximate. Antennae about half as long as body, 3rd joint but little longer than 2nd, half as long as 4th, joints 4–11 much wider than 2nd and 3rd, subequal in length, about twice as long as wide at apex. Thorax almost semicircular, finely margined throughout, base bisinuate, disc moderately densely punctate, each puncture giving rise to a slender hair. Elytra seriate-punctate, intervals almost flat, each with three fairly regular lines of elongate punctures almost as large as those of the striae, which are thus rendered rather indistinct; all punctures setigerous. Penultimate joint of all tarsi produced beneath the claw joint as a broad flat lobe, and the preceding joint of two anterior pairs similarly but to a less degree produced beneath. These two joints above are very short, together shorter than the second joint.

I do not know either of the species on which Fairmaire founded the genus *Cistelopsis*, but it appears to contain a considerable number of closely allied Oriental species.

31. **Cistelomorpha congrua (Cistela),** op. cit. ii, 286.

Entirely yellow (antennae beyond 4th joint wanting) with the last ventral segment reddish. Elytral intervals subequal, convex, rather sparsely punctate, 4th and 5th striae shortest, not united at apex, 3rd and 6th united beyond them, 7th stria a little short of uniting with 2nd, 8th still shorter, 9th (marginal) stria almost uniting with 1st.

Closely resembles *C. calida* All., from Madura, but the thorax and elytral interstices are both less densely punctate, and the antennae (so far as present), tibiae and tarsi are not black, and the last ventral segment is reddish instead of black. A form occurs with a black humeral spot on the elytra and a black discal spot at about $\frac{2}{3}$ of their length, thus resembling *C. calida* var. *nigromaculata* All. (= *trabealis* Fairm.), but it may be distinguished by its pale legs and hypopygium as well as by the less dense puncturation of the thorax and elytral intervals.

Fam. LAGRIIDAE.

32. **Sora marginata,** op. cit. iii, 260 (Oedemeridae).

It is probable that many of the Oriental species of *Casnonidea* and *Nemostira* will have to be included under *Sora*. The more salient features of the genus are the elongate slender form, striate elytra, of which the alternate intervals have a few widely spaced setigerous punctures, the large eyes, moderately approximate above, but more widely separated beneath the head; the slender antennae, of which the second joint is elongate, more than half as long as the third, and the last joint in both sexes greatly elongate, as long as the three preceding together.

The type of *S. marginata* remains unique in the British Museum. It is flavous, apparently immature, with the tips of the antennae and femora faintly infuscate, and a broad fuscous streak running from the humerus nearly to the apex of the elytra; but this coloration is probably very inconstant.

N.B.—*Thaccona dimaelana,* op. cit. iii, 260 (Oedemeridae), has already been stated by Mr. Champion to be an *Idgia* (= *I. cardoni* Bourg.), Ann. and Mag. Nat. Hist. (9) iii, 1919, p. 360.

Fam. RHIPIPHORIDAE.

33. **Geoscopus languidus (Acosmius),** op. cit. ii, 286.

The type, again still unique in the British Museum, agrees well in generic characters with *G. murinus* Gerst.

The streaks on the thorax and two transverse fasciae on the elytra, one about the middle and the other apical, that Walker describes as "non-tomentosis," are in reality as pubescent as the rest, but the pubescence is dark.

Fam. MORDELLIDAE.

34. **Mordella composita,** op. cit. ii, 286.

M. tonkinea Pic.
?M. OCTOGUTTATA Montr.

A widely distributed Oriental species, liable to some variation in the white markings. In the type the basal white border of the thorax is of almost even width, the antemedian transverse fascia is interrupted in the middle and produced backwards in a longitudinal streak each side of the interruption. Also there is a short oblique white streak on each elytron bordering the scutellum. These last, as well as the longitudinal streaks on the thorax, are sometimes wanting, and in some cases the transverse fascia of the thorax is continuous. The other spots are as follows: a round one in the middle of each elytron near the base, and a transverse marginal streak a little behind; these with the scutellar streak are almost on an arc of which the humeral angle is the centre. Behind these but before the middle is a round spot touching the sutural stria, and rather more than halfway between this and the apex is another round spot about the middle of the disc. This last is liable to elongation in a transverse direction, while that towards the base is liable to longitudinal elongation.

The identity of this species with *M. octoguttata* Montr., from Woodlark Island is a little doubtful on account of the widely different locality. Fairmaire records what is probably the same species from Burma (Ann. Soc. Ent. Belg. 40, 1896, p. 61) as *M. octoguttata*.

35. **Mordellistena defectiva (Mordella),** op. cit. iii, 260.

Dark, reddish-brown, not black, as described by Walker, with the head, antennae and legs ferruginous. Antennae slender, 2nd joint about equal to the 1st, 3rd and 4th short, together scarcely longer than the 2nd, 5th to 11th elongate, subequal, about 3 times as long as wide. Elytra short, not covering the prepygidium. Posterior tibiae with 5 oblique comb-ridges, none of them reaching halfway across the tibia; 1st tarsal joint with 4 short ridges, 2nd with 3, and 3rd with 2. Anal style long and slender.

The type is a ♂ with the genital armature protruding beyond the tip of the style.

A ♀ from Kandy (G. E. Bryant) has the last seven joints of the antennae stouter, only about twice as long as wide, and the elytra longer, extending a little beyond the base of the pygidium.

Fam. MELOIDAE.

36. **Mylabris humeralis,** op. cit. ii, 285.

M. PUSTULATA Thunb.

A common and well-known insect from Ceylon and S. India.

37. **Mylabris alterna,** op. cit. ii, 285.

M. THUNBERGI Billb.

Of two specimens so named, one is labelled in Walker's handwriting, and agrees with the description. the other lacks the sutural black spot behind the median fascia. This is apparently *M. kandyana* Pic., and should be regarded only as a variety of *M. thunbergi*.

38. **Decapotoma recognita (Mylabris),** op. cit. iii, 259.

D. ROUXI Cast.

The type has completely lost the yellow patch usually enclosed in the broad black apical patch of the elytra. To this extent the name may be retained as a colour variation of *D. rouxi*, but a series will show all stages in the disappearance of this patch.

N.B.—This species would almost be better placed in *Coryna* than in *Decapotoma*. The large club-like last joint of the antennae certainly shows a suture near its base, but

the degree to which this is visible varies greatly, and in some specimens there appear to be only nine joints.

39. **Sybaris nigrifinis (Epicausta),** op. cit. ii, 284.

Lytta usta Fairm.

The upper branch of the claws in this species, as well as in the closely allied *L. testacea* F., is pectinate, so that both must be transferred to *Sybaris*.

Fam. ANTHICIDAE.

40. **Anthicus stricticollis,** op. cit. iii, 260.

Apparently related to *A. fugax* and *A. fossicollis* Laf. Elytra squarish at the shoulders, feebly convex, nitid, rather feebly and sparsely punctate and pubescent; yellowish, with a broad transverse median dark fascia and the apex also fuscous, the enclosed yellow area transversely crescentic, convexity towards apex.

The type remains unique in the British Museum.

II

The Coleoptera collected by J. K. Lord in British Columbia were presented by him to the Museum (Reg. No. 64.18), the new species being described by Walker. Most of the species have been recognised by later writers and referred to earlier described species, in many cases they bear a later label in Mr. C. O. Waterhouse's handwriting, "named by Leconte" (in one case with the date, 2.11.69.).

The types of the Heteromera are as follows:—

1. **Iphthimus servilis.**
2. **Iphthimus servator.**
3. **Iphthimus subligatus.**

These are all forms of I. SERRATUS Mann.

The first two are of the form common in British Columbia in which the punctures of the elytral striae are elongate and deeply impressed. *I. servator* is an abnormal individual with the sides of the prothorax somewhat up-turned in front. *I. subligatus* has the punctures of the striae small and not deeply impressed, as in specimens from California (det. Horn). It differs from these in the elytra being more opaque and the thorax more rugosely punctured.

4. **Eleodes subtuberculata.**

E. GRANULATA Lec. (*fide* Leconte).

The type remains unique in the British Museum.

5. Eleodes convexicollis.

E. OBSCURA Say, ♀.

6. Eleodes binotata.

E. HISPILABRIS Say, forma *laevis* Blaisd.

Two specimens, both ♀. In Junk's Catalogue *E. binotata* Walk., is placed as a synonym of *E. sponsa* Lec., a species apparently of more Southern distribution. The type agrees exactly with the description of the forma *laevis* Blaisd., of *E. hispilabris*.

7. Eleodes conjuncta.

E. OBSCURA Say, ♂.

Stated by Walker to be "like *H. convexicollis* in structure" (*vide supra*).

8. Eleodes latiuscula.

E. HUMERALIS Lec. (*fide* Leconte).

9. Helops inclusus.

H. CONVEXULUS Lec. (*fide* Horn).

The type bears an additional label "*Helops convexulus* Lec. (Horn)," and is apparently correctly determined.

10. Epicauta immerita (Lytta).

E. SERICANS Lec.

This identity was suggested with some doubt by Dr. Horn in 1873. Unfortunately I have no named specimens of *E. sericans* for comparison, but the description and comparison of the latter with the nearly allied *E. ferruginea* Say, certainly seem to confirm his opinion.

Both these names were published in 1866, but as Part I of Leconte's "New Species" bears date "March–April" 1866, it is probable that this has priority.

11. Nemognatha bicolor.

N. APICALIS Lec. (*fide* Leconte 2.11.69).

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Session 1921–1922.

1921.

Wednesday,	October	5
,,	,,	19
,,	November	2
,,	,,	16
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1922.

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IX. *A List of the Erotylid Coleoptera of Indo-China, with descriptions of new species.* By Gilbert J. Arrow, F.E.S., F.Z.S.

[Read June 1st, 1921.]

Amongst the large collections of insects, chiefly from the banks of the Upper Mekong River, made in the course of the last few years by Mr. R. Vitalis de Salvaza, the Erotylidae are very numerous. The conspicuous colouring and habit of exposing themselves characteristic of the members of this family make them an especially easy prey to the collector, who is not, like other enemies, repelled by their unpalatable quality. Many species were taken in large numbers by Mr. Vitalis and, as a result of his exertions, the number of those recorded from Indo-China is now considerably more than doubled. Of the total number of 49 species now known from the region, only four or five of which were not found by him, no less than 23 are in my opinion new to science. The total number of species enumerated by Gorham in 1896 from the adjacent region of Burma was 33.

The bright black and red or yellow patterns so general in this group are liable to mislead if relied upon for the discrimination of the species, for series of specimens apparently identical in pattern, as well as in size and shape, may prove upon a microscopic examination to belong to many species and even genera. Standardisation in outward appearance has evidently been acquired, by reason of the advantage afforded by the readier recognition of their unpalatability by potential enemies. Deceived in this way, Mr. Gorham, in the paper just referred to, actually associated, under the name *Episcaphula elongata*, six different species, none of them really belonging to *Episcaphula elongata*. Two of the six are here described, as *Megalodacne major* and *affinis*.

Phonodacne, new genus.

Moderately elongate, smooth and shining. Head with a pair of stridulatory files placed far back upon the vertex and normally concealed entirely within the cavity of the pronotum. Eyes moderately large. Antennae with the third joint markedly longer than the fourth and the club elongate and closely articulated.

Clypeus rather long, narrow in front. Mentum large, broad, hollowed beneath and obtusely angulate in front. Terminal joint of the labial palpi broad and securiform. Maxilla unarmed, densely hairy, with the inner lobe short, the outer lobe rather slender. Maxillary palpus with the last joint triangular, not enlarged nor transverse. Mandible sharply bidentate. Prosternum broadly produced behind. Legs strong, with the tibiae rather clavate, the three basal joints of the tarsi broadly lobed and the fourth minute.

♂. Front and hind tibiae strongly curved.

Type, *P. angusta*, sp. n.

This genus is nearly related to *Megalodacne*, from which it differs principally by the possession of a pair of stridulatory files upon the vertex of the head. These are placed so far back as to be visible only when the head is drawn a little out of its cavity, the files not extending forward as far as the hinder margin of the eye. The tarsi are very broadly dilated and the maxillary palpi have a securiform terminal joint, which is not enlarged nor distinctly transverse.

Episcapha stridulans Gorham is a second species of the genus, and another is *Megalodacne curvipes* Fairmaire (Nyasaland). In the latter species, as in *P. angusta*, the stridulatory files are placed far apart, but in *P. stridulans* they are close together.

1. **Phonodacne angusta**, sp. n.

Nigra, nitida, singulo elytro lunula humerali ad basin attingenti, postice tridentata, fasciaque anteapicali intus abbreviata, pallide flavis, ornato; elongata, convexa, capite fortiter punctato, clypeo angustato, crebrius punctato, oculis mediocris, pronoto sat crebre punctato, marginibus lateralibus laevigatis, basi utrinque fortiter et profunde punctato, lateribus subtiliter arcuatis, antice leviter approximatis, angulis anticis acutis, posticis rectis; scutello lato; elytris subtiliter seriato-punctatis, postice laevigatis; prosterni dimidio antico crebre punctato, margine antico medio minute tuberculato:

♂, tibiis anticis et posticis arcuatis.

Long. 20 mm.; lat. max. 8 mm.

Upper Mekong: Pak Lay (Aug.), Ban Pan (May).

This is larger and more elongate than *P. stridulans*, with similar but rather reduced markings upon the elytra. The head and pronotum are rather closely punctured, the

former becoming gradually less so from front to rear. The stridulatory files are much farther apart than in the latter species. The pronotum is not much broader than it is long, gently narrowed to the front and smoother at the sides, with the lateral margins well marked, especially near the angles, which are sharp, the anterior ones produced. The elytra have rows of fine punctures, which vanish posteriorly. The prosternum is strongly and densely punctured in its anterior part and slightly carinate along the middle line, the carina terminating in a slight tubercle.

The male has the front and hind tibiae curved and serrated at the inner edge, the hind tibiae having the serrations very well marked and not close together.

2. **Megalodacne elongatula,** Crotch.

Laos : Pak Lay (August).

This species is easily recognised by the two lines of close irregular punctures which divide the pronotum longitudinally. The male has a minute tuft of erect hairs near the end of the last ventral segment.

I may mention here that the Malaccan "*Triplatoma*" *varia* of Gorham belongs to the genus *Megalodacne*, Gorham having been deceived by the similarity of its markings to those of *T. gestroi* Bedel.

3. **Megalodacne vitalisi,** sp. n.

Nigra, modice nitida, singulo elytro fasciis duabus rufis ornato, antica obliqua, lunata, intra humerum ad basin attingenti (angulo humerali quidem nigro), postice medio dentata, fascia postica anteapicali, transversa, antice tridentata, postice arcuata; angustissima, convexa, antice et postice attenuata, capite fortiter punctato, clypeo angusto, oculis prominentissimis, grosse granulatis; pronoto ubique sat fortiter punctato, quam longitudinem parum latiori, lateribus antice leviter arcuatis, angulis acute productis, postice fere rectis, parallelis, angulis rectis, basi medio lobato, depresso; scutello transverso; elytris distincte seriato-punctatis, interstitiis subtiliter punctulatis; prosterno fortiter haud crebre punctato, metasterni medio fere laevi, lateribus parce punctatis; antennis gracilibus, prothoracis basin transientibus, clava laxe articulata.

Long. 6·5–9 mm.; lat. max. 2·5–3·5 mm.

Upper Mekong : Ban Nam Mo, Nam Mat, Pou Bia (Jan.–June), Luang Prabang.

Taken in great abundance.

It is a narrowly elongate insect, with the prothorax only a little broader than it is long, the elytra tapering and the upper surface rather strongly punctured, especially the head and pronotum. The elytra are ornamented with two red fasciae rather remote from one another, the anterior one extending in an oblique curve from the outer margin to near the suture and reaching the base just within the humeral angle, which is black, the posterior one scarcely interrupted at the suture, arched behind and produced in front into three points upon each elytron. The antennae are slender, extending backwards beyond the base of the pronotum, with a very loosely articulated club. The prosternum is rather strongly, but not closely, punctured and the metasternum is almost smooth in the middle and rather scantily punctured at the sides. This species is very close to *M. elongata* Guér., Java (wrongly attributed to Burma in Kuhnt's catalogue), but of narrower form, more convex and less shining. The width of the prothorax is much less than half as much again as its length (that attributed by Lacordaire to Guérin's species). The pattern and the puncturation are almost identical with those of *M. elongata*.

4. **Megalodacne major**, sp. n.

Nigra, opaca, singulo elytro fasciis duabus rufis ornato, antica obliqua humerali, ad basin attingenti, postice tridentata, postica transversa subapicali, antice tridentata, postice arcuata: anguste ovalis, convexa, capite crebre parum fortiter punctato, oculis grosse granulatis, pronoto subtiliter punctato, punctis nonnullis prope basin majoribus, leviter transverso, lateribus regulariter arcuatis, antice convergentibus, angulis anticis acute productis, posticis rectis, basi fortiter lobato, scutello transverso, elytris subtiliter seriato-punctatis, interstitiis minutissime et parce punctulatis; corpore subtus magis nitido, grossius punctato.

Long. 8·5–11 mm.; lat. max. 3·5–4·5 mm.

Upper Mekong R.: Pou Bia, Nam Mat, Ban Nam Mo, Ban Thiou (Jan.–April), Luang Prabang. Burma: Karen Hills (*L. Fea*, May).

This closely resembles *M. vitalisi* and the red elytral pattern is identical, except that the humeral lunule sends two extensions instead of one to the base of the elytron, leaving a small black dot between. It is a little larger, more oval in shape and rather more opaque above, the

puncturation being rather finer, except a few large punctures near the base of the pronotum. The puncturation of the elytral intervals is extremely minute, and the rows of punctures are generally less evident. The pronotum is very convex, about half as wide again as its length, with acutely produced front angles. The lower surface is much less strongly punctured than in either *M. vitalisi* or *affinis*, the sides of the prosternum alone being strongly punctured, the metasternum almost smooth and the abdomen shining but scantily punctured. The antennae are shorter than in *M. vitalisi*, not extending beyond the base of the pronotum, but the club is loosely articulated. Joints nine and ten are twice as broad as they are long.

5. **Megalodacne affinis,** sp. n.

Nigra, singulo elytro fasciis duabus rufis ornato, antica obliqua, bis ad basin attingenti, postice dentata, postica transversa, subapicali, antice et postice medio dentata; oblonga, modice elongata et convexa, capite et pronoto fortiter sat crebre punctatis, oculis prominentissimis, grosse granulatis, pronoto quam longitudinem fere duplo latiori, lateribus leviter arcuatis, angulis anticis fere rectis, posticis obtusis; scutello late transverso; elytris seriato-punctatis, interstitiis subtilissime punctulatis, prosterno fortiter haud crebre punctato, metasterno ubique, lateribus fortius, punctato; abdomine subtus sat fortiter et dense punctato; antennis modice elongatis.

Long. 6·5–8 mm.; lat. max. 2·5–3 mm.

Upper Mekong R.: Ban Nam Mo, Sala Pang Yok, Pou Bia, Pak Lay (Jan.–June), Luang Prabang, Vientiane. Burma: Bhamo (*L. Fea*, June).

The red markings are practically the same as in *M. major*, except that the posterior band is not arched behind, but slightly toothed. *M. affinis* has a deceptive resemblance to *M. vitalisi*, and occurs in almost equal abundance in the same localities. It is of the same size and similarly punctured above, and the elytral pattern is the same, except that the anterior red band touches the base of the elytron at two points, with a small black dot between. It is less slender in shape, the prothorax more transverse, its sides more rounded, the front angles not acute and the hind angles rounded. The elytra are less attenuated behind. The antennae are less slender, not extending beyond the base of the pronotum, and the joints of the club are broader.

The lower surface is more strongly and closely punctured, the metasternum distinctly punctured in the middle.

6. **Megalodacne eximia,** sp. n.

Nigra, nitida, singulo elytro maculis rufis duabus subrotundatis ornato, prima posthumerali, leviter transversa, ad marginem externam attingenti, secunda anteapicali; elongata, parum convexa, supra fortiter, capite sat crebre, punctata, oculis prominentissimis, pronoto paulo minus crebre et aequaliter punctato, quam latitudinem paulo breviori, lateribus parallelis, fere rectis, antice laevissime incurvatis, angulis anticis acutis, posticis rectis, basi transverse impresso, medio lobato; scutello lato; elytris medice fortiter seriatopunctatis, interstitiis minute punctulatis; prosterno fortiter punctato, metasterno ubique subtiliter et parce, abdomineque subtus fortius et crebrius punctato; antennis gracilibus, articulis 3–8 elongatis, 9–11 laxe articulatis.

Long. 8 mm.; lat. max. 3 mm.

Upper Mekong: Ban Thieu (March), Luang Prabang.

Only two specimens were taken.

This also resembles *M. vitalisi*, but is much less nearly related to it. The red marks are of more regularly rounded shape, the upper surface is more shining and less convex, the punctures larger and the sides less curved. The prothorax is little shorter than it is wide, its sides nearly straight and parallel, except in front, where they are lightly curved, with acute front angles. The prosternum is strongly punctured, closely at the sides and rather scantily in the middle, the metasternum finely and thinly punctured all over, and the abdomen distinctly but not closely punctured except upon the terminal segment. The tibiae are rather shorter and flatter than in the three species just described, and the antennae longer, but with a similar loosely-articulated club.

7. **Megalodacne hislopi** Crotch.

Laos: Xieng Khouang (April).

A wide-ranging insect found in many parts of India, the Philippine Islands, etc.

8. **Episcapha 4-maculata** Wied.

Laos: Vientiane, Cuarao, etc.

This is found in profusion in Indo-China, as in all parts of the Indo-Malayan Region.

9. **E. taishoensis** Lewis.

Laos: Luang Prabang, Xieng Khouang (March–May). Tonkin (June).

A species only recorded hitherto from Japan.

10. **E. indica** Crotch.

Laos: Luang Prabang, Xieng Khouang, Pou Bia (Jan.–June). Tonkin: Chapa (June). Burma. Assam. Sikkim.

The pale yellow markings are a little narrower than in Indian specimens, and the humeral spot is a little larger in consequence, but I have found no more important difference. It is this form which has been described as *E. chapuisi*, Dohrn.

11. **E. psiloides** Bedel.

Tonkin: Than Moi (June, July).

Easily recognisable by its conspicuous hairy clothing and pale markings.

12. **E. curvicrus** Bedel.

Tonkin.

I have not seen this species.

13. **Episcapha ambigua,** sp. n.

Nigra, haud nitida, singulo elytro fasciis duabus angustis pallide flavis ornato, antica post humerum posita, ad marginem externam fere attingenti, et ad marginem basalem connexa, postica ante-apicali arcuata, antice quadri-, postice tri-dentata; elongato-ovalis, supra nuda, pedibus antennisque gracilibus, capite et pronoto grosse sat crebre punctatis, hujus lateribus bene arcuatis, marginibus sat latis, ante medium minute incrassatis; elytris coriaceis, fere opacis, convexis, lateribus bene arcuatis; corpore subtus crebre et minute punctato, vix perspicue pubescenti; antennarum articulis 2–9 elongatis, tertio quam quarto haud longiori.

Long. 16 mm.; lat. max. 6·5 mm.

Laos: Luang Prabang, Sala Pang Yok (March).

A single specimen only.

Although the pattern is almost identical with that of *E. indica*, this is a peculiar and isolated species which, by the curvature of the sides of the prothorax and elytra, shows an approach to *Triplatoma*, *Trichulus*, etc. The eyes are larger than in that group of genera, and, with the short third antennal joint, determine the true relationship

of the species. The upper surface is devoid of hair, but not at all shining, the head and pronotum being strongly punctured and the elytra of a leathery texture and almost opaque. The legs and antennae are slender, all but the first and the last two joints of the latter being markedly elongate, but the third barely as long as the fourth. The eyes are divided by an interval equal to twice their radius. The pronotum has a rather broad elevated margin with a small lateral pore close to each extremity and another situated in a slight thickening a little before the middle.

14. **Nesitis ulyssis** Bedel.

Tonkin (June).

15. **Nesitis nigricollis** Bedel.

I do not know this species, recently described by M. Bedel with the last-mentioned one.

16. **Encaustes gigantea** Boh.

Laos: Xieng Khouang, Pou Bia (Nov., Jan.).
Also found in Assam.

17. **E. malayana** Guér.

Laos: Luang Prabang. Upper Mekong R.: Ban Nam Mo, Muong Sai, Vien Poukha (March–May).

This is a smaller form than the last, with less straight sides to the prothorax and the small black dots upon the elytra united at the base.

18. **E. flavofasciata** Kuhnt.

Tonkin.
Unknown to me.

19. **E. cruenta** Macl. var. **montana** Schenkl.

Upper Mekong R.: Pou Bia, Nam Mat, Vien Poukha, Tong King, etc. (Nov., Jan., April, May).

Herr Schenkling's note on *E. cruenta* Macl., the type of which is in the British Museum, shows that he has mistaken *E. marginalis* Crotch for that species.

20. **Encaustes laticollis**, sp. n.

Nigra, laevissima, pronoti annulis duabus medio conjunctis, utrinque ramis tribus emittentibus, elytrorum humeris rufomaculatis, callo extremo nigro lunulaque anteapicali ornata; elongata, capite haud fortiter punctato, pronoto lato, vix perspicue punctato, prope

basin utrinque impresso, puncto minuto profundo signato, margine antico leviter arcuato, utrinque paulo impresso, angulis anticis rotundatis, lateribus fere rectis et parallelis, angulis posticis vix obtusis; scutello latissimo; elytris longis, subtiliter striatopunctatis, apicibus rotundatis, haud truncatis:

♂, pedum anticorum femoribus arcuatis, tibiis intus lamina obtusa prope medium instructa.

Long. 18–24·5 mm.; lat. max. 7–9 mm.

Upper Mekong R.: Pou Bia, Pak Ho, Kok Ya (Oct., Jan.).

This is very nearly allied to *E. birmanica* Gorh. and *praenobilis* Lewis (Japan). Its red and black markings are almost those of the latter, but the red shoulder-mark has a black spot upon the summit of the callus and the apical mark has an arched hinder edge. In addition, the upper surface is a little less glossy and the pronotum is without the strong punctures at the sides and base. It is still more closely related to *E. birmanica* (which, however, has the elytra entirely black), but the forelegs of the male are different from those of both the other species, being less slender and bearing a long carina, instead of a tooth, at the inner edge. Of *E. birmanica* (male), Gorham says: "anterior femora armed with an acute tooth a little before the middle and an obtuse one near the base," and, comparing it with *E. praenobilis*, "in the male the tooth on the inner side of the front femora is quite differently situated." This is an error, for, although the femora have a prominence at the extremity, it is the tibia and not the femur which he is describing.

21. **Micrencaustes dehaani** Cast.

Laos: Luang Prabang, Xieng Khouang (April, May).

A species ranging from Assam to Java.

22. **M. atropos** Kuhnt.

Unknown to me.

23. **M. liturata** Macl. (and var. **nigripennis** Kuhnt).

Laos: Luang Prabang, Xieng Khouang, Vien Vai, Ban Sai (Sept., Nov., March–May).

This was found in great abundance. The red apical mark is generally, although not always, absent in these specimens.

24. **Micrencaustes apicalis,** sp. n.

Nigra, pronoto rufo, margine irregulari punctisque duobus discoidalibus nigris exceptis, elytrorumque macula subapicali antice bisinuata rufa; elongato-ovata, convexa, capite sat magno, haud dense punctato, oculis magnis, remotis, pronoto convexo, parce subtilissime punctulato, lateribus arcuatis, antice et postice contractis, basi fortiter trisinuato, utrinque area triangulari profunde punctata signato; scutello lato; elytris distincte lineato-punctatis; tibiis intermediis apice extus acute spinosis.

Long. 13–17 mm.; lat. max. 5·5–7 mm.

Upper Mekong R.: Ban Thiou, Sala Pang Yok (March), Nam Mat (April), Luang Prabang.

One of the group of species with the apex of the middle tibia acutely produced.

The pronotum is convex and very smooth, scarcely broader behind than in front, its sides evenly rounded, the base having on each side a strongly punctured area of triangular shape extending to about one-third the length of the pronotum. The prosternum is not very sharply pointed in front, and the mesosternum is transversely rectangular, with an impressed stria, nearly straight in front and at the sides.

This species has the closest resemblance to *M. liturata*, but in addition to the presence of a red apical spot upon the elytra (not a sublateral stripe, as in *M. liturata*) and the fusion of the two red marks upon the pronotum, the head is rather larger, the eyes larger and rather farther apart, the prothorax more shining and convex, its sides more strongly rounded, the microscopic puncturation sparser, and the large punctures on each side of the base extend a little farther forward. The lines of punctures upon the elytra are rather less fine and close.

25. **Micrencaustes elongata,** sp. n.

Nigra, parum nitida, singulo elytro maculis duabus rufis ornato, lunula humerali intus late haud longe producta ad basin atque marginem lateralem attingenti lunulaque anteapicali fere ad margines internam et externam attingenti; angusta, parum convexa, capite crebre punctato, pronoto ubique subtiliter sed distincte punctato, utrinque ad basin fortiter et copiose punctato, lateribus vix arcuatis, antice convergentibus, angulis anticis acutis, posticis fere rectis; scutello transverso; elytris discrete seriato-punctatis; tibiarum

intermediarum apice extus spinoso; abdominis apice subtus punctis magnis profundis marginato.

Long. 14·5–18 mm.; lat. max. 6–7 mm.

Upper Mekong: Ban Nam Mo (March, April), Ban Thiou (March), Luang Prabang.

The Museum contains a specimen taken by Boden Kloss at Korinchi, Sumatra, which appears identical with those taken by Mr. Vitalis.

It is a long and rather narrow species, not very convex nor very shining. The head and prothorax are rather small relatively, and rather closely punctured, the former strongly, the latter finely in the middle but fairly strongly at the sides, with a cluster of large punctures on each side of the base. The rows of punctures upon the elytra are well marked. A peculiar and distinctive feature is a row of ten or twelve large deep punctures occupying the hind margin of the last ventral segment. The middle tibiae are acutely spinose at the end. The clypeus is short, the eyes large and separated by little more than the diameter of one of them.

It has a deceptive resemblance to *Megalodacne elongatula* Crotch.

26. **Micrencaustes siamensis,** sp. n.

Nigra, subopaca, singulo elytro maculis duabus fulvis ornato, lunula humerali ad basin attingenti, postice bis dentata, fasciaque anteapicali antice tri-, postice bi-dentata, fere ad marginem externam attingenti; elongato-ovalis, modice convexa, capite distincte, clypeo fortius punctato, pronoto subtiliter punctato, lateribus bene marginatis, leviter arcuatis, angulis anticis acutis, posticis fere rectis; scutello transverso; elytris subtiliter lineato-punctatis; tibiis intermediis apice haud spinosis.

Long. 14–17·5 mm.; lat. max. 6·5–7·5 mm.

Siam; Laos: Xieng Khouang.

This species and *M. convexa* are closely related to *M. lunulata* Macl., which they resemble in their form and markings, differing in the absence of markings upon the thorax. In addition *M. siamensis* is larger and more elongate, the upper surface is less shining than in *M. lunulata*, and the puncturation of the head and pronotum is a little stronger. As in *M. lunulata*, the middle tibiae are not acutely produced at the end.

27. **Micrencaustes convexa,** sp. n.

Nigra, nitida, singulo elytro maculis duabus fulvis ornato, lunula humerali ad basin producta et postice bis dentata fasciaque anteapicali antice tridentata fere ad marginem externam attingenti; elongato-ovalis, convexa, capite bene punctato, clypeo rugose; pronoto minute sed distincte punctato, lateribus bene marginatis, leviter arcuatis, angulis anticis acutis, posticis fere rectis; scutello transverso; elytris sat discrete seriato-punctatis; tibiarum intermediarum apice haud spinoso.

Long. 14 mm.; lat. max. 6 mm.

Upper Mekong R.: Ban Pan, Nam Tiene (April, May).

Very closely related to *M. siamensis*. As in that species the middle tibiae are not spinose at the end. It is a little shorter, more convex and more shining than *M. siamensis*, with slightly more distinct punctures, those upon the elytra especially being larger and farther apart. The orange markings are almost identical, but the humeral mark does not extend quite so far from the basal margin.

28. **Micrencaustes planicollis,** sp. n.

Nigra, haud nitida, elytris flavo-bifasciatis, fascia antica basali callum humeralem punctosque duos minutos nigros amplectente, postice oblique quadri-emarginata, fasciaque anteapicali transversa, angusta, antice et postice bi-emarginata; elongata, angusta, oculis magnis, clypeo parvo, fortiter et crebre punctato, fronte subtilius punctata; pronoto sat plano, ubique minute punctato, lateribus fere rectis, antice paulo contractis, angulis anticis acutis, posticis rectis; scutello subrotundato, minutissime punctulato; elytris minutissime seriato-punctatis; prosterno antice acute producto, mesosterno linea trapeziformi circumdato; tibiarum intermediarum apice spinoso.

Long. 15 mm.; lat. max. 6 mm.

Laos: Xieng Khouang (April).

A rather narrowly elongate species with pale yellow transverse bands upon the elytra, of which the first reaches the base, partially surrounds the shoulder spot and includes two smaller black spots placed transversely, and the posterior one is narrow, transverse and tridentate both in front and behind. The upper surface is rather opaque, the pronotum especially. The sides of the latter are nearly straight and parallel, except in front where they are gently curved. The shape of the scutellum of the unique specimen is peculiar, the margin being almost uniformly rounded except for the basal emargination.

29. **Micrencaustes navicularis,** sp. n.

Nigra, nitida, singulo elytro fascia transversa anteapicali rufa ornato, fascia haud arcuata, antice et postice acute dentata, ad marginem internam et externam haud attingenti; modice elongata, nitida, capite parvo, clypeo angusto, fortiter crebre punctato, fronte minutius et parcius punctata; pronoto ubique minute sed distincte punctato, lateribus leviter arcuatis, antice convergentibus, angulis anticis acutis, posticis rectis; scutello brevissimo sed postice angulato; elytris distincte sat laxe seriato-punctatis, postice attenuatis; prosterno valde acuminato, mesosterno linea semicirculari impresso, tibiis apice haud spinosis.

Long. 13·5–15 mm.; lat. max. 6–6·5 mm.

Laos : Pou Bia (Jan.).

This is another species of the group in which the middle tibiae are not spinose at the end. It is the only species of the genus known to me of which the pattern consists of a red posterior band only. This band is exactly transverse, interrupted at the suture, and has a triple emargination of its front edge and a double emargination of its hind edge upon each elytron. The insect is only of moderate length, but tapers rather more markedly than usual both before and behind. The elytral striae are distinctly but not closely punctured. The mesosternum bears an impressed semicircular stria.

30. **Aulacochilus quadripustulatus** F.

Tonkin : Hoabinh (Aug.). Laos : Luang Prabang (Nov.).

31. **A. episcaphoides** Gorh.

Laos : Luang Prabang, Pou Bia (Dec., Jan.).

A common species in Assam and Burma.

32. **A. luniferus** Guér.

Laos : Luang Prabang, Ban Nong, Muong Sai, Pou Bia (Dec., Jan., Mar.).

33. **Aulacochilus sternalis,** sp. n.

Cyaneo-niger, haud nitidus, elytris fascia lata rufa basali, utrinque puncta dua nigra (quorum majore humerali ad marginem conjuncto) includente, fasciaque angustiori postmediana valde sinuata ornatis, fasciis vix ad latera attingentibus, antica ad suturam interrupta, postica fere integra; oblongo-ovatus, con-

vexus, capite pronotoque ubique fortiter punctatis, hoc parum convexo, lateraliter paulo excavato, marginibus bene elevatis, elytris punctato-striatis, interstitiis subtiliter punctulatis; prosterno antice producto, acuminato, striis lateralibus antice abbreviatis, mesosterno brevissimo, linea arcuata transversa inciso, metasterno fortiter punctato, segmento ventrali basali utrinque linea brevi inciso.

Long. 7·5—9 mm.; lat. max. 3·5—4·5 mm.

Laos: Luang Prabang (March, April).

This closely resembles *A. luniferus* Guér. It is a little larger, with the juxta-scutellar spot detached, the humeral one united to the lateral border but not elongate, and an additional postmedian red fascia, which reaches the sutural margin and almost attains the external margin. The prosternum is sharply produced in front, the mesosternum is very short and transverse and has a complete semicircular stria, the prosternum is coarsely punctured at the sides, the metasternum strongly and evenly punctured everywhere, the abdomen closely punctured, the basal segment with short straight coxal lines. The pronotum is flattened at the sides, strongly punctured, with sharply raised lateral margins.

34. **Aulacochilus laoticus**, sp. n.

Niger, singulo elytro fascia posthumerali subcruciformi fere ad marginem anticam attingenti et infra humerum paulo producto fasciaque anteapicali minore transversa medio constricta rufis ornato; oblongo-ovatus, convexus, haud nitidus, capite pronotoque ubique fortiter punctatis, hoc convexo, marginibus lateralibus bene elevatis, angulis obtusis, elytris striatopunctatis, interstitiis subtiliter punctulatis; prosterno haud producto aut elevato, stria integra antice et lateraliter inciso, mesosterno brevi, stria arcuata impresso, metasterni medio modice punctato, abdominis segmento basali linea longa angulata versus latera producta utrinque inciso.

Long. 8·5—9 mm.; lat. max. 4 mm.

Laos: Xieng Khouang (April), Luang Prabang, Ban Nam Mo (April).

Closely related to *A. sternalis*. The ground-colour is black without blue tinge, the juxta-scutellar black spot is united with the sutural border, and the anteapical red patch is placed farther back and is very short. The pronotum is more convex, the prosternum has no process in

front but is rounded and has a marginal stria, complete except at the hind margin, the mesosternum is very short and has a semicircular stria, the metasternum is finely punctured, the abdomen closely punctured, and the coxal lines of the basal segment are long and continued parallel to the hind margin almost to the sides of the abdomen.

35. **Aulacochilus fraterculus,** sp. n.

Niger, singulo elytro fascia lata basali aliaque anteapicali parva arcuata fulvis ornato, fascia basali maculas 4 minutas includenti, quarum duabus internalibus, tertia humerali ad basin, quarta ad marginem externam sitis; oblongo-ovatus, convexus, haud nitidus, capite fortiter, pronoto subtilius punctato, hujus marginibus lateralibus bene elevatis, leviter arcuatis; elytris minute striato-punctatis, interstitiis subtilissime punctulatis; prosterno haud acuminato aut elevato, utrinque stria brevi inciso, mesosterno sat brevi, utrinque brevissime striato, metasterno abdomineque subtiliter punctulatis, hujus segmento primo ventrali utrinque linea arcuata fere ad marginem posticam attingenti inciso.

Long. 6·5—8 mm.; lat. max. 3·5—4·5 mm.

Upper Mekong R.: Ban Pan (May), Tong Lap (April), Pou Bia (Jan.), Luang Prabang (April).

This closely resembles *A. vitalisi* Arrow and *episcaphoides* Gorh., but is smaller and a little more elongate than the former and a little less so than the latter. The pattern is almost that of *A. episcaphoides*, but the ground-colour is black without blue tinge, the outlines are less sharply defined and the apical patch is produced backwards externally almost to the apices of the elytra. The prosternum is scarcely elevated in front, and not at all sharply pointed. It is longitudinally impressed and bordered by long striae which converge without meeting. The coxal lines of the first ventral segment are continued almost to the hind margin of the segment, where they are sinuous.

36. **Aulacochilus vitalisi,** sp. n.

Niger, parum nitidus, elytris fulvis, singulo marginibus suturali et externali, maculis duabus basalibus, duabus antemedianis (quarum interiori cum marginem suturalem plus minusve confusa), fascia postmediana extus dilatata ad margines internam et externam attingenti guttaque apicali cum margine conjuncta ornato; ovalis, convexus, pronoto paulo deplanato, irregulariter sat fortiter punc-

tato, marginibus lateralibus bene elevatis, elytris distincte striato-punctatis, lateribus reflexis; prosterno haud acuminato, utrinque inter coxas stria inciso, mesosterno etiam utrinque stria arcuata inciso, metasterni medio fortiter punctato, linea longitudinali impresso, abdominis segmento ventrali basali utrinque stria sat brevi obliqua inciso.

Long. 7·5—10·5 mm.; lat. max. 4·5—5·5 mm.

Upper Mekong R.: Pou Bia (Jan.).

This is extremely similar to *A. javanus* Guér. and of the same size and shape. The pattern is the same, but the elytral spot adjoining the scutellum is placed a little farther away, so that it is quite separated from the sutural line, and the postmedian black band is not completely detached from the lateral black border as in *A. javanus*. The lateral striae of the mesosternum are longer than in the latter, but the coxal lines of the first ventral segment are shorter, not bending round parallel to the hind margin as in that species.

37. **Aulacochilus janthinus** Lacord.

Laos: Luang Prabang, Vien Poukha, Sala Pang Yok (March, April, May). India. Malayan Region.

I am unable to distinguish *A. sericeus* Bedel from this very common and widely-distributed species.

38. **Amblyopus vittatus** Oliv.

Tonkin: Hoabinh (Aug.).

This is also very abundant and widespread in the Oriental region.

Genus Tritoma.

The species of this genus are extremely numerous and of practically world-wide distribution. In the recent catalogue of Kuhnt they are scattered under various generic names. It appears to me impossible to separate the genus *Triplax*, the difference being one of superficial form only, a feature which is subject to almost infinite variation. The genus *Tritoma* was created by Fabricius in 1775 for *T. bipustulata* and other species. On the ground that Fabricius' genus was not that of Geoffroy, Crotch in 1872 renamed it *Cyrtotriplax*, designating *T. bipustulata* as the type. In 1873 he named an American species (*humeralis* F.) as the type; but since Geoffroy's names (not being uniformly binomial) are not now accepted,

Cyrtotriplax becomes a synonym of *Tritoma* F. In his subsequent "Revision" (1876) Crotch reverted to the European *T. bipustulata* F., but Kuhnt's Catalogue, attributing the name *Cyrtotriplax* to Gorham, adopts the latter's extraordinary proposal to use Crotch's name for Oriental species only. Another genus, *Pseudotritoma*, was made by Gorham in 1888 for Oriental species mistakenly referred to *Tritomidea* Mots. (a synonym of *Euxestus*) by Crotch, but without any attempt to differentiate it from *Tritoma*. Two species (*atripennis* and *xanthosticta* Gorh.) remain in the catalogue under *Tritomidea*, to which they are not related. Another series of species was separated by Gorham as *Triplacidea*. His genus *Phoxogenys*, the affinities of which he failed to elucidate, is scarcely distinguishable from *Cyrtomorphus*, as at present understood.

39. **Tritoma bella** Kuhnt.

Laos: Vien Poukha (May). Tonkin (Kuhnt).

Determination of this is quite uncertain, for Kuhnt's few words do not really amount to a description.

40. **T. basimaculata** Kuhnt.

Unknown to me.

41. **T. nigripennis** Mots.

This is very probably the Burmese species named *Cyrtotriplax cebana* by Gorham, and nothing is given in the fragmentary description of *T. atripennis* Kuhnt by which that can be distinguished from *T. cebana*, except rather smaller size, to which no particular importance need be attached, but Kuhnt's name in any case is invalid, having been previously used by Gorham.

Tonkin (Kuhnt).

42. **T. oppositipunctata** Gorh.

Kuhnt has recorded this from Tonkin, but it is possible his insect is a form of *T. vitticollis*, mentioned later.

43. **Tritoma vitticollis,** sp. n.

Nigra, pronoti lateribus late, prothorace et abdomine subtus, antennarumque articulis 2, 3 et 4 flavibus, elytris plerumque leviter aeneis; oblongo-ovata, nitida, capite sat fortiter punctato, clypeo margine recto, oculis haud parvis, prominentissimis, pronoto medio distincte, lateraliter subtilius, punctato, marginibus lateralibus

leviter arcuatis, angulis anticis paulo productis, haud acutis, posticis fere rectis, basi medio leviter lobato; scutello transverso, parce punctulato; elytris punctato-striatis, stria suturali indistincta, metasterno medio minute et parce, lateraliter fortius punctato, antennarum articulo tertio quam quarto paulo longiori, clava laxe articulata, angusta.

Long. 4—6 mm.; lat. max. 2·3—3·3 mm.

Upper Mekong R.: between Luang Prabang and Vientiane.

Black, with the pronotum (except a broad median black stripe), the prosternum and abdomen beneath and joints two to four of the antennae pale yellow.

A very abundant insect, varying considerably in size. In some specimens the interruption of the black longitudinal thoracic stripe produces a pattern like that of *T.* ("*Cyrtotriplax*") *oppositipunctata* Gorh. and *T. motschulskyi* Bedel, but the yellow colour of the present species is much paler, and the legs and the mesosternum and metasternum are quite black. It is also generally larger, of less regularly oval shape than *T. motschulskyi*, and more strongly punctured both above and beneath than *T. oppositipunctata*.

The elytra have usually a slight brassy lustre. The antennae are moderately long, the third joint rather longer than the fourth, and the club long, narrow and loosely jointed. The punctures of the pronotum are finer at the sides than in the middle, and the lateral margins are more curved than in the other species here described.

44. **Tritoma atriceps,** sp. n.

Pallide flava, capite, elytris, meso- et metasterno antennarumque articulis 9 et 10 nigris, pronoti marginibus antica et postica medio plus minusve infuscatis; ovalis, nitida, convexa, capite aequaliter sat fortiter et crebre, pronoto paulo subtilius, punctato, clypeo antice leviter emarginato, pronoti lateribus subtilissime arcuatis, angulis anticis vix acutis, posticis rectis; elytris striato-punctatis, stria suturali antice valde oblique ad basin protracta, interstitiis sat parce punctatis, metasterni medio subtiliter et parce, lateribus fortius punctatis; antennis brevibus, articulo tertio ad duos sequentes conjunctim fere aequali, tribus ultimis transversis, parum compactis.

Long. 3·5—4 mm.; lat. max. 2—2·5 mm.

Upper Mekong R.: between Luang Prabang and Vientiane.

T. atripennis Kuhnt, which, so far as the fragmentary descriptions indicate, appears not to differ from *T. nigripennis* Mots., has only the elytra and scutellum black, whereas in this species the head, scutellum, elytra, mesosternum and metasternum and the two penultimate joints of the antenna are black and the rest of the body pale yellow (not orange). There is also generally a very narrow and inconspicuous dark marginal line at the middle of the front and hind edges of the pronotum.

The first elytral stria is distinct, strongly oblique anteriorly and running close to the suture behind. The metasternum is very feebly punctured in the middle, more strongly at the sides. The club of the antenna is moderately broad but not closely-jointed.

45. **Tritoma repetita,** sp. n.

Fulva, oculis, pronoti punctis duobus medianis, uno ad marginem anticam, altero ad marginem posticam, elytrisque nigris; late ovalis, nitida, convexa, capite et pronoto aequaliter et fortiter punctatis, clypeo bene emarginato, pronoti lateribus leviter arcuatis, angulis anticis acutis, posticis rectis, basi medio lobato; elytris striato-punctatis, interstitiis subtiliter punctatis, spatio suturali antice lato fortius punctato; metasterni medio crebre, lateribus parcius punctatis; antennis brevibus, articulo tertio ad duos sequentes conjunctim fere aequali, tribus ultimis modice compactis.

Long. 4·5 mm.; lat. max. 3 mm.

Tonkin: Hoabinh (Aug.).

It is possible that *T. atripennis* Kuhnt is a phase of this species without the two marginal black spots upon the pronotum. This is happily immaterial, since the name *atripennis* falls, having been previously used for a closely-related species by Gorham, but entirely misplaced by him, *Tritomidea*, as I pointed out in 1917, being synonymous with *Euxestus*. *T. repetita* is entirely orange-red in colour, with the exception of the eyes, a spot in the middle of the front margin of the pronotum, a corresponding spot at the hind margin and the elytra. This pattern like others is recurrent in this genus, most of the species of which seem to be rather localised, but the very similar *T. motschulskyi* Bedel and *T. oppositipunctata* Gorh. have

the head and part of the lower surface black. It is of broadly oval form and well punctured above and beneath. There is a rather wide and closely-punctured space on each side of the elytral suture, the first stria being practically obliterated. The metasternum is closely punctured in the middle and much less closely at the sides. The club of the antenna is rather long and compactly jointed.

46. **Tritoma alternata,** sp. n.

Nigra, capite (oculis exceptis), prothorace, elytrorum fascia lata mediana communi, pedibus antennisque (clava fusca excepta) pallide flavis; oblonga, modice angusta, convexa, nitida, capite et pronoto fortiter punctatis, hoc medio paulo subtilius, oculis parum parvis, clypeo antice leviter emarginato; prothoracis marginibus lateralibus subtiliter arcuatis, angulis omnibus obtuse rectis, basi haud valde lobato; scutello vix transverso; elytris distincte lineato-punctatis, interstitiis irregulariter et parcius punctatis; prosterno fortiter punctato, metasterno minus fortiter, medio parce punctato; antennis gracilibus, clava laxe articulata.

Long. 4—5·5 mm.; lat. max. 2 mm.

Laos: between Luang Prabang and Vientiane.

This has the narrow form which serves as practically the only distinguishing feature of the genus *Triplax*, but, as the proportions vary with every species, it is not possible to find any natural dividing line in this respect. The coloration is peculiar. The head, prothorax, a broad transverse band crossing the middle of the elytra from side to side, the antennae (except the club), the legs and the prosternum and mesosternum are pale yellow, the remaining surface black. The antennae are rather long and slender, with a narrow loosely-jointed club, and the tibiae are not very broad. The puncturation of the head and pronotum is strong and the elytra have well-marked rows of punctures, between which are incomplete rows of similar punctures.

47. **Tritoma solitaria,** sp. n.

Pallide flava, elytris nigris clavaque antennali fusca; oblonga, modice elongata, convexa, nitida, capite et pronoto sat fortiter punctatis, clypeo angusto, haud emarginato, prothoracis lateribus subtiliter arcuatis, angulis omnibus obtuse rectis, baseos medio late lobato; scutello transverso, laevi; elytris distincte lineato-punctatis, interstitiis parce et subtilissime punctatis, prosterno

fortiter punctato, metasterno minus fortiter; tibiis haud latis, antennis parum gracilibus, clava sat laxe articulata.

Long. 4 mm.; lat. max. 2 mm.

Laos: between Luang Prabang and Vientiane.

A single specimen.

Although a little smaller, this has the same rather narrow form as *T. alternata*, to which it is closely related, but the lower surface, including the legs, is entirely pale in colour, and the elytra are entirely black. The antennae are rather shorter than in that species, and the club is a little more compact and abrupt. The head and pronotum are a trifle less strongly punctured than in *T. alternata*, and the interstitial punctures of the elytra are less evident. The clypeus is narrow and not emarginate in front.

48. **Tritoma ornata,** sp. n.

Laete fulva, capitis vitta mediana, prothoracis macula antica geminata vel bilobata, elytrisque nigris, his fascia antemediana multidentata transversa maculaque utrinque apicali triangulari fulvis ornatis, clava antennali (apice excepto) nigra; ovalis, convexissima, nitida, corpore supra ubique sat crebre punctato, clypeo parum brevi, fortiter emarginato, oculis modice prominentibus, pronoti marginibus lateralibus vix arcuatis, angulis omnibus fere rectis, basi anguste lobato; elytris fortiter punctato-striatis; corpore subtus subtiliter, lateribus fortius, punctatis; antennarum articulo tertio quam quarto plus duplo longiori, clava ovali, modice compacta, articulo 9 lato, 11 minuto.

Long. 4—5 mm.; lat. max. 2·5—3 mm.

Upper Mekong R.: Ban Nong (Dec.), Pou Bia (Jan.).

This is intermediate between the rather depressed preceding insects and the short and convex species represented by *T. bipustulata* F. It is more elongate than the last, more closely punctured, with more strongly marked elytral striae, and has longer antennae and tibiae, the antennal club being of the same general form but less compact. The last joint of the labial palpus is only a little wider than it is long. The coloration is like that of no other described species. The legs and lower surface are yellow, the head is yellow with a longitudinal median black line, the pronotum is yellow with two oval black spots more or less united occupying the middle of the front margin and extending backwards beyond the middle

of the thorax. The extreme hind margin of the pronotum is also black, as are the scutellum and elytra, the latter being decorated with a transverse orange band before the middle, sometimes interrupted at the suture, and a triangular patch in the posterior angle of each, not quite reaching the margin.

49. **Cyrtomorphus curtus** Gorh.

Laos: Luang Prabang, Ban Nam Mo, Pou Hai Katoui.

This is also found in the Malay Peninsula and Sumatra. It varies from 6 to 8 mm. in length.

Note.—Five species of Erotylidae from Indo-China were enumerated by Gorham under the name "Encaustidae" (Ann. Soc. Ent. France, 1891, p. 399). Two of his identifications are certainly quite wrong (viz., the West African *Tritoma senegalensis* Crotch, and the Ceylonese *Euxestus translucidus* Mots.), and two others I am not able to confirm. As I have not seen the specimens on which the list is based (which are in the collection of M. Ed. Fleutiaux) I have disregarded Gorham's names altogether in the preceding paper.

X. *Mimicry of Ants by other Arthropods.* By Horace Donisthorpe, F.Z.S., etc.

[Read June 1st, 1921.]

Mimicry.

Numerous Arthropods are very ant-like in appearance, and such resemblances are not surprising considering that ants are on the whole very well protected. Their protection is brought about by many different causes, especially the vast numbers in some colonies all ready to come to each other's assistance, and overwhelm an enemy by sheer weight of numbers. They also possess various methods of offence and defence — well-developed stings; poison and repugnatorial glands, ejecting acid and offensive discharges; marked odours; hardness of integument; defensive spines, etc., etc. I propose to divide the mimicry of ants into the following sections :—

1. Mimicry of ants by other Arthropods which do not live with them, neither feeding on, nor having any direct association with them. Such mimics are in no way Myrmecophiles, and may be called Simple Myrmecoids. Perhaps the best-known example is the little Locustid *Myrmecophana fallax* found in the Soudan [and perhaps in Rhodesia also; see Poulton "Essays on Evolution," 257 *n.* 1 (1908)]; its resemblance to an ant is brought about by the arrangement of pale colouring beneath and on the sides, and not by the actual shape of the insect. Various spiders, bugs (Heteroptera and Homoptera, including the Membracids with ant-like shields, and the curious larval Membracid resembling an ant carrying a leaf), wasps, Longicorn Coleoptera, all belong to this division, which includes a number of our own beetles belonging to the genera *Clivina*, *Dyschirius*, *Miscodera*, *Stilicus*, *Notoxus*, and *Anthicus*.

The beetle *Clerus formicarius* has also been considered to be an ant-mimic, in which case it would therefore come under this heading. I, however, consider it to be a *Mutilla*-mimic.*

2. Mimicry of ants by other Arthropods which do not

* See Donisthorpe, "Cases of Protective Resemblance, Mimicry, etc., in the British Coleoptera," Trans. Ent. Soc., London, 1901, 376.

live with their models, but do feed on them. These may be called Myrmecoid Myrmecophags. Some spiders, tiger-beetles, etc., may be given as examples.

3. Mimicry of ants by other Arthropods, which both live with the ants, and also feed on them. These are the Myrmecoid Synechthrans. One of the best examples is the jet black *Myrmedonia funesta*, much resembling the ant with which it occurs. Wasmann has expressed his opinion that the object of this mimicry is to deceive the ants; but I am unable to agree with him, considering rather that the likeness protects the beetle from outside enemies; for the beetle when attacked by its host can always defend itself by powerful repugnatorial discharges. In common with other Myrmedonias, it curls up when disturbed, and looks like a fragment of earth, but this is its second line of defence. The insect is frequently found in the "runs" of the ants, at the entrance and outside the nest, where its resemblance to an ant would be of value against the attacks of enemies other than its host.

Some of the mimetic spiders and also bugs (Heteroptera of the genera *Alydus*, *Myrmecoris*, *Systellonatus*, *Nabis*, etc.) may belong to this group, at any rate during the times when they associate with ants as they commonly do. It is also possible that the species referred to prey on their ant models.

4. Mimicry of ants by other Arthropods which are generally found in company with ants, or near their nests, but attack other insects, etc. These are partly Myrmecoid Synoeketes. Species of the genus *Gonatopus* are good examples, as they are very ant-like and often found with ants, but prey on small Homoptera. Some spiders, and the bugs mentioned in the last section possibly belong here, for it is not certainly known whether they feed on the ants. They are all very ant-like, especially in the larval stages, when their bodies are shaped like those of the ants. In *Nabis*, however, the resemblance is brought about in a different manner like that producing the likeness in *Myrmecophana*. The sides of the base of the abdomen are white with a dark mark in the middle like the pedicel of an ant. Viewed in profile there is also an elevation like the ant's scale. This species has been observed to suck the eggs of Lepidoptera, and other species of bugs in the neighbourhood of ants [see Butler, Ent. Mo. Mag., **57**, 80 (1921); and Donisthorpe, Ent. Mo. Mag., **57**, 136 (1921)].

5. Mimicry of ants by other Arthropods which always live with their hosts. This section includes the Myrmecoid Synoeketes, of which the best examples are the guests of the Driver ants (Dorylii) of tropical Africa and Asia, and the legionary ants (Ecitonii) of the warmer portions of America. The species are principally Staphylinid beetles, and among them are some of the most remarkable ant-mimics in the world. As their hosts have no fixed abode these Synoeketes live as camp-followers, moving from place to place in company with the ants, and feeding on the plentiful booty obtained by them. Perhaps the most wonderful of all is the Staphylinid beetle *Mimanomma spectrum*, a Doryline guest, whose whole body is modified in the most extraordinary manner, to imitate that of its hosts.

Mimeciton pulex is also a very curious insect which lives with an *Eciton* in Brazil. Wasmann, to whom we are indebted for our knowledge of nearly all these Doryline guests, considers that the form and hairiness of *Mimeciton* are for the purpose of deceiving its hosts, whilst its ant-like colour protects it from outside enemies when running along in company with *Eciton*. As the Doryline ants are blind, but possess a keen sense of touch, it is highly probable that in such cases as this Wasmann's interpretation is correct.

6. Mimicry of ants by other Arthropods which always live with their hosts, and are fed and licked by them—these are the true guests, or Myrmecoid Symphiles. The Staphylinid beetle *Lomechusa* is always to be found in parts of the nest where the ants are thickest. Here it is to be found sitting amongst and crawling over the ants, and when at rest practically indistinguishable from them. The reason being that the light which is reflected from the concave sides of the thorax appears to the eye like the narrow back of an ant, and the rolled-up abdomen of the beetle reflects the light in the same way as the rounded gaster of a large ant. The species of another Staphylinid genus *Atemeles* are not only ant-like, but also mimic the ants' movements. When an *Atemeles* desires to be fed it not only solicits an ant by tapping with its antennae as does *Lomechusa*, but it further mimics the actions of its hosts by stroking the side of the head of the ant with its front feet. These actions are also performed by the larva of *Xenodusa*, the American representative of *Lomechusa*,

which having longer legs than the larva of the latter, can walk about and solicit the ants for food by raising itself and stroking their cheeks with the anterior pair of feet.

7. Mimicry of ants by other Arthropods which live with the ants, and lay their eggs in them or their brood—Myrmecoid Entoparasites. Mann records the capture in Brazil of several specimens of a remarkable wingless Proctotrypid—*Mimopria ecitonophila*, which runs about in company with the legionary ant *Eciton hamatum*. They were good mimics of the small workers, and very ant-like in their movements. Chitty found in a nest of *Tetramorium caespitum* in Kent a wingless Proctotrypid which resembled very closely this ant. This section also includes various other mimetic *Proctotrypidae*, and probably also some ant-like *Ichneumonidae* of the genus *Pezomachus*, which are found with ants.

8. Mimicry of ants by other ants of different genera—Myrmecoid Formicidae. Forel has commented on the close superficial resemblance between the minor workers of *Colobopsis truncata* and workers of *Dolichoderus* 4-*punctatus*, considering the likeness to be due to mimicry. These forms of the two species resemble each other in size, gait, and behaviour; both have spotted gasters, being the only European ants with such markings, and both often occur together on walnut-trees. Moreover, *Camponotus lateralis* may also be found with the other two species which they resemble in general colouring and behaviour. Finally, all three sometimes inhabit the same tree as *Cremastogaster scutellaris* and may be looked upon as mimics of the latter ant. I found the *Colobopsis* and the *Cremastogaster* living in the same pieces of "virgin" cork at Kew Gardens accompanied by a beetle *Formicomus pedestris* which closely resembled the *Colobopsis*. It has been suggested that these resemblances are only accidental, but this conclusion is by no means certain. Ants of the genus *Dolichoderus* possess well-developed repugnatorial glands, and the numerous species of *Cremastogaster* are dreaded by other ants. Mann has observed that the Cremastogasters are always avoided by the fierce Brazilian Ecitons, even when marching in column.

Santschi has shown that the female of *Bothriomyrmex decapitans* possesses a similar odour (not present in her own workers) to that possessed by the workers of *Tapinoma nigerrimum*, on which she is a temporary social

parasite. This is a case of olfactory mimicry. [Rev. Zool. Africa, **7**, 216 (1920).]

9. Mimicry of Myrmecophiles found together with them in the same ants' nests—Myrmecophile mimics of Myrmecophiles. The "Lady-bird" *Coccinella distincta* is a good example of such mimicry, for it superficially resembles the beetle *Clythra 4-punctata*, and both are found in and about the nests of *Formica rufa*. This is an instance of Müllerian mimicry, as I have shown the *Clythra* to be distasteful to "insectivorous animals," and the *Coccinellidae* are known to be so.

Another example which may be similar to the above is that of an Ichneumonid, *Microcryptus nigrocinctus*, several females of which I found in company with a number of *Myrmedonia collaris* in a nest of *Myrmica laevinodis* at Wicken Fen. The head, elytra, and tip of the abdomen of the beetle are black, and the rest of the surface bright red, and as the Ichneumon is coloured in a similar manner, they bear a strong superficial resemblance to each other.

10. Resemblance to inanimate objects by Myrmecophiles —Protective Resemblance. Before leaving the subject of Mimicry, it may be as well to refer briefly to a few cases of protective resemblance among ants' guests. Species of the genus *Monotoma* when at rest look like bits of wood; and it has already been pointed out that the Myrmedonias, in their second line of defence, feign death and resemble fragments of earth; while the larval cases of *Clythra* and *Cryptocephalus* and the pupal case of *Cetonia*, etc., look like lumps of earth in the nest—these last being examples of "adventitious" or allocryptic resemblance. *Amphotis marginata*, a true guest, is very like a bit of bark, and it is often found under, or on the bark of trees inhabited by its hosts. To these, other instances might be added.

XI. On the Life-history of Boreus hyemalis *L.* By C. L. Withycombe.

Plate VIII.

[Read October 5th, 1921.]

Last December I exhibited before this Society some specimens of *Boreus hyemalis* together with eggs of the same. Having now more or less completed my observations on the life-history of this insect, I have much pleasure in submitting an account thereof.

Fig. 1. *Boreus hyemalis*, ♂.

Fig. 2. *Boreus hyemalis*, ♀.

In Epping Forest *Boreus* first appears as the perfect insect in November and may possibly exist right through the winter as such, but personally I cannot claim to have taken it later than December.

As is also the case with other members of the Mecoptera, *Boreus* possesses a long rostrum, at the end of which are situated the mandibles, toothed internally and fitted for biting. The head also bears two large compound eyes but no ocelli.

In both sexes the wings are reduced, but especially so in

the female, which is completely apterous except for a pair of small scale-like lobes on the mesothorax. The male has two pairs of curved bristle-like wings. Each anterior wing is stiff and covered with spines. On its hind margin it is grooved and acts as a covering to the hind-wing, which is much less hairy and not so strongly chitinised. The abdomen of the male is curved upwards at the apex and bears the complex genitalia. The posterior dorsal margin of the second abdominal segment in that sex is produced upwards into a small erect lobe, which is obliquely truncated, appearing as a small forwardly directed ridge when viewed from the side. In the female there is a long ovipositor giving the insect somewhat the appearance of a female Locustid. A point of interest about the adult is the presence of a peculiar sieve of chitinous, doubly grooved bristles in the proventriculus, as is also found in other Mecoptera, in the flea, and in crickets.

On first escaping from the pupa the colour is greenish yellow, but in a day or so this darkens, the back and sides of the head, thorax and abdomen becoming bronzy brown or bronzy green, the rest of the body including rostrum being yellowish brown.

Length about 3 mm.; of female with ovipositor 5 mm.

In November the insects may be found running about on the surface of moss, often in numbers. They are, however, very local, and may be found in plenty on a patch of moss six feet across, while another patch a few yards away is totally devoid of specimens.

Normally it runs slowly about, but on being disturbed jumps six inches or more, then usually lying still for a minute or so before resuming its perambulations. It is quite active in pouring rain, but I have never seen it above the snow. I went twice to localities in which I knew *Boreus* to occur, one day, and two days after a fall of snow (four inches approx.), and each time found no insects running on the snow. I am not aware that it is distasteful to birds, but should it possess no obnoxious properties one would expect it to be speedily devoured under such circumstances. Both robins and tits were much in evidence on these occasions. I have never observed any offensive smell to be given off by the insect, but once on irritating one (female) I noticed a somewhat nutlike odour similar to that given off by some species of *Polydesmus*.

The food of *Boreus* appears to be largely fluid animal matter, judging by the stomach contents, but I have never seen it attack living insects. The only specimen which remained alive for any length of time was a female, which was kept going for thirty-seven days on the juices of crushed flies. Insects, however small, were not touched so long as they showed any signs of life, but a fly, crushed so as to force out some of the body contents was accepted —the soft parts alone being eaten. I am therefore obliged to conclude that the imagines feed on damaged or dead insects. Without food the males usually died in just over a week, the females in two or three weeks.

Pairing takes place shortly after emergence, the male carrying the female on its back as in the case of the flea.

The female lays eggs from time to time, but with me these have always been laid singly or at most two at a time. Little use is apparently made of the long ovipositor for boring, as no eggs were found deeper than the bases of the moss plants.

The moss preferred by the insect in Epping Forest appears to be *Mnium hornum*, but larvae have been found in other mosses.

The egg is ·5 mm. long × ·3 mm. broad, white and translucent when first laid. The surface is smooth except for very slight granulations. Little change in colour is noticeable as hatching approaches, which usually occurs on the ninth or tenth day with an average temperature of 47° F. About half the eggs laid were, however, sterile. Ten was the maximum number laid by a single female, but had she lived longer more might have been obtained, as examination after death showed at least a dozen eggs in the oviducts.

Hatching took place from the end of November to the beginning of December, but being rather fully occupied and seeing several eggs still unhatched I postponed examining the larvae for a week. After this period had elapsed they were about 1·5 mm. long and quite similar in structure to the full-fed larva. The remaining eggs from which I had hoped to obtain larvae for examination immediately on hatching, proved to be sterile. I am therefore not in a position to confirm Brauer's observation that the newly hatched larva possesses abdominal prolegs.

On the 27th December (four weeks after hatching) the larvae—fed on moss—were 3 mm. long. At this stage

four were isolated and fed separately to ascertain the nature of their food. The stomach contents of wild larvae was wholly moss fragments both green and decayed, nevertheless I wished to know whether other food could be taken.

A. was placed in damp sand and supplied from time to time with crushed flies, insect larvae, etc.
B. was placed in fine leaf mould, sifted as far as possible free from moss fragments.
C. was supplied with leaf mould and the decayed lower portions of moss plants.
D. was kept with living moss only.

C. and D. continued growing quite normally and fed on the materials provided.

B. grew slowly and evidently found some food, as it was full fed by the end of April.

A. lived until the beginning of February (five weeks), but evidently could not feed, as the alimentary canal was always empty; it did not grow at all and died after the above period. I think it is therefore certain that the food of the larva is moss, living or decayed.

The first larvae noticed to be full grown were found on the 19th December in the Wake Valley, Epping Forest, but those in captivity did not reach that state before the end of February or beginning of March. I could not observe the number of larval instars, as for some reason or other no cast skins could be found even when larvae were kept in small tubes ($1\frac{1}{2}'' \times \frac{1}{3}''$). While not wishing to believe that the skins are eaten by the larva after moulting, it is nevertheless difficult to imagine that they could have been overlooked in so small a space. Judging from the growth in size of the head from time to time I should say that there were at least four ecdyses.

Larvae are to be found in moss from December to August, usually in the substance of the moss carpet, but occasionally just under the same, making short passages on the surface of the soil three to four inches long. Brauer appears to have found them under liverworts (lebermoose).

When full fed the larva is about 6 or 7 mm. long, with a yellowish-brown chitinous head and a white semi-transparent body. It rests with the body curved in a semi-circle and much resembles a weevil larva of the genus

Phyllobius or *Polydrusus*, with which it frequently occurs, but from the latter it can at once be distinguished by the possession of three pairs of legs which stand stiffly out on each side of the thorax. On the head are a pair of simple eyes situated laterally but rather near the jaws. In front of the eyes are the antennae, each of which is two-jointed, the basal joint being short and situated in a small pit. The second joint is longer and bears a single bristle. The mandibles are fitted for biting and are toothed internally. From the centre of the labium between the two palpi arises a small pointed organ which appears to serve as a spinneret, similar to that found in lepidopterous larvae. It is connected with glands in the thorax and fore part of the abdomen.

Fig. 3. *Boreus hyemalis*, larva full fed.

The thorax is the broadest part of the larva and bears the very curious and conspicuous legs. Each leg has a broad basal segment. The second joint is longer, and the third rod-shaped and cylindrical, not pointed. The abdomen, which is somewhat narrower than the thorax, is cylindrical, curved, and bears a few small bristles on each segment.

Larvae may be found by breaking up moss at any time during the spring and summer, mosses in which I have found them being *Mnium hornum*, *Dicranella heteromalla* and *Bryum atropurpureum*, but principally the first. The larvae are very sluggish and move little on being disclosed.

As pupation approaches the larva makes a vertical tube leading almost to the surface, and it is presumably at this period that the fine silk thread is spun which sometimes

sparsely lines the walls. This silk lining is, in my opinion, by no means always present, although being never very noticeable I may have overlooked it. The larva now rests motionless. The legs become considerably shorter, especially the second and third pairs. The change to pupal state usually takes place in September, but last year I found pupae in mid-August.

The pupa is far more active than the larva, wriggling up and down the tube rapidly on disturbance. All the characters of the adult are visible, but the rostrum, and ovipositor in the case of the female, are somewhat shorter than in the adult. The wings of the male lie at the sides of the thorax, the legs and antennae also at the sides but rather more ventrally. The colour is at first white, then yellow, and just before emergence greenish brown.

The imago appears in November after a pupal period of four to eight weeks.

On the 21st September of this year I took sixteen female pupae and one larva about to pupate. Three young larvae, however, were also found, the smallest being 2 mm. long and the largest 2·5 mm. All were still feeding. Judging by the time usually taken in growth these larvae were probably not more than a week or two old, and if such is the case they may be the result of a summer brood. It is quite possible that a few pupate in summer and emerge, while the great majority are single brooded. I know that this happens with many normally single-brooded Neuroptera. On the other hand, this phenomenon may be due in some way to the long dry summer. My captive larvae have shown no tendency to early pupation. It will be interesting to see whether the specimens in question will emerge this year. Those previously noticed as being full fed on the 19th December continued until the following autumn as larvae.

From one larva, taken when nearly full fed from the Forest, a single larva of a parasitic Hymenopteron emerged on the 31st March. After making its way partly to the surface of the moss it commenced to spin a pale yellow cocoon between the moss plants vertically. On a former occasion I had found two yellowish cocoons about $\frac{1}{4}$ inch long spun vertically between the moss plants, which cocoons belonged undoubtedly to the same parasite. Unfortunately they were not kept. The larva in question did not complete its cocoon, and hardly had it pupated

before it was attacked and killed by mould and mites. The damaged pupa was at once preserved in spirit, but is useless for identification purposes. It appears to be that of a wingless insect. I have been unable to obtain any more specimens of the parasite since. To attack *Boreus* it must appear in the early part of the year, and one would ask what host, if any, it selects from August to December, also in what stage is *Boreus* attacked, as the egg or larva?

Since writing this note I have observed several imagines bruising the bases of green moss leaves with their mandibles and quite plainly feeding thereon for a minute or two at a time.

I have also to add that females on being disturbed exude a drop of colourless fluid, of pungent odour, from the tip of the ovipositor. This liquid is however by no means so malodorous as that of *Panorpa*.

C. L. W. Nov. 21, 1921.

Books referred to.

Brauer. Verhandlungen Zoologisch-Botanischen Vereins in Wien, 1863. Pages 320–323.

MacLachlan. Monograph of British Neuroptera-Planipennia. Trans. Ent. Soc., 1868.

Explanation of Plate VIII.

Fig. 1. *Boreus*, ♂ (actual length 3·5 mm.).
2. „ ♀ (actual length 5 mm.).
3. „ ♂ and ♀ (slightly enlarged).
4. „ eggs in moss (actual length ·5 mm.).
5. „ egg („ „ „ ·).
6. „ full-fed larva (dorsal view) (× 2).
7. „ full-fed larva (side view) (× 2).
8. „ pupa in moss, ♂ (× 3).

C. L. W. photo. *Vaus & Crampton, Ltd.*

LIFE HISTORY OF BOREUS HYEMALIS

XII. *Five Years' Observations* (1914–1918) *on the Bionomics of Southern Nigerian Insects, chiefly directed to the Investigation of Lycaenid Life-histories and to the Relation of Lycaenidae, Diptera, and other Insects to Ants.* By the late Charles Ogilvie Farquharson, M.A., B.Sc., Aberdeen. Edited, with a brief life of the author, by Edward B. Poulton, D.Sc., M.A., F.R.S., Hope Professor of Zoology in the University of Oxford, Fellow of Jesus College, Oxford. With a systematic and descriptive Appendix by R. S. Bagnall, G. T. Bethune-Baker, Dr. T. A. Chapman, F.R.S., J. E. Collin, J. Hartley Durrant, F. W. Edwards, Dr. Harry Eltringham, D.Sc., M.A., Prof. J. Bronté Gatenby, D.Phil., D.Sc., Prof. R. Newstead, F.R.S., Prof. E. B. Poulton, F.R.S., Prof. F. Silvestri, Dr. J. Villeneuve, and Dr. James Waterston, B.D., D.Sc.

[Read June 2nd, 1920.]

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Charles Ogilvie Farquharson, 1888–1918.

By Prof. E. B. Poulton.

The fine and accurate observer whose letters and collected material form the subject of the following memoir was born on February 13, 1888, on a farm at Murtle, in the valley of the River Dee, a few miles west of Aberdeen. At the age of about eleven he went to Robert Gordon's Secondary School, where it is remembered that he worked well and took a good place; also that country walks were a greater attraction to him than games.

In October, 1905, he entered the University of Aberdeen, at first as a student of English, Latin and Greek, but changing to Natural Science in July, 1907. His letters supply plenty of evidence that the two years at Classics had left a strong and lasting impression. Out of many passages I select the following because it also brings out his love for the insects he was studying. The name "*parsimon*," which filled him with horror, was given to a West African Lycaenid butterfly by no less an authority than Fabricius, the favourite pupil of Linnaeus.

"'*Parsimon*' calls only for compulsory Greek for science students: [see also p. 398]. There ought to be a sub-committee of the 'Entomological' for the protection of the good name of nice insects, with special reference to such fair masterpieces of Nature's handiwork as the Lycaenids. Yesterday I saw a beautiful 'Copper,' probably only a few hours after emergence [see p. 380]. It was simply too beautiful to capture. I hoped that one day I might breed a few out, to keep some and let the others away, just in case there might not be enough to keep the race going [Dec. 9, 1917]."

After graduating as M.A. in 1908, Farquharson continued his scientific work for the B.Sc. which he took "with special distinction in Botany," in 1911. He entered upon this science in April, 1908, and then first came under the influence of the great and inspiring teacher, the late Prof. James W. H. Trail, one who did not treat Botany as an isolated subject but always brought the relation between plants and animals before his pupils. Prof. Trail remembered that Farquharson, when a student, possessed "unusual power in distinguishing the essential from less

important matters in each problem that presented itself to him, as well as in working out solutions to these problems, so as to make each addition to his knowledge a real gain" (C., p. 139).

Prof. Trail also told me that Farquharson was "one of the best among the many who have passed through our University; and I felt," he wrote, "no doubt as to the quality of the work that was done by him, for he was thorough and forgetful of self in whatever he undertook, and the love of natural science was inborn in him, along with exceptional ability."

For all his hard work and keen interest in many studies Farquharson entered with avidity into the literary and social life of the University, taking an active part in the Debating Society, the Sociological Society, of which he was at one time President, and editing and writing for "Alma Mater." His friends too "recall many long evenings in his company in bygone days, when a few kindred spirits were wont to meet to settle all the problems of the universe" (B.).

In 1911 Farquharson was appointed Mycologist to the Agricultural Department of Southern Nigeria—happy in finding a career in the one subject which attracted him most. Before starting, early in 1912, to West Africa, he spent some months of specialised study in London, chiefly at Kew. It was probably at this time that he came under the second great influence which affected his whole outlook. How much he owed to the late George Massee is best expressed in the words of one of his last letters.

"I ought to add," he wrote to Dr. A. W. Hill, F.R.S., on August 23, 1918, "that George Massee's economic-mycological outlook has influenced most things I have done, perhaps not as published, but in the intimate expression of his views that he used to give at Kew. Again and again I have wished he were alive. Kew wasn't the same place to me last time I was home" (D., p. 354).

The Agricultural Department, which, except for his visits to Agege and other places in Southern Nigeria and his leaves in the Old Country, was to be Farquharson's home for the rest of his life, is situated at Moor Plantation (480–580 ft.), about 4 miles west of Ibadan, and here the great majority of the observations recorded in this memoir were made. His first researches, upon the Mycetozoa, appeared in an important paper written in collaboration with Miss

G. Lister, the distinguished authority on the group (Journ. Bot., vol. liv, 1916, pp. 121–33, pl. 541).

Farquharson had been a year at Moor Plantation when he came under a third great influence, and one which was to determine the direction of his later researches; for, in May 1913, W. A. Lamborn, an extraordinarily keen and accurate observer of insect life, became his colleague as Government Entomologist.

How his interest came to be aroused is told in a letter written to me on February 10, 1914 :—

"I have to thank you for your most kind and encouraging letter which I received by last mail and for the many kind references to myself in your letters to Dr. Lamborn. I greatly fear, however, that you are giving credit where very little is due. Perhaps he has not explained how I came to bring him in the specimens which he generously contributed in my name to the Hope Collection. In my spare time I was collecting some fungi for Kew and Myxomycetes for Miss Lister, and of course in passing I met with some insects that looked interesting which I took to Dr. Lamborn. Under the stimulus of his enthusiasm I became interested in the curious habits of many of the insects and wrote one or two notes at his suggestion.

"It is largely due to the Myxos that the work was done. One has to look rather closely for these, and the relatively gross, if I may so use the word, phenomena of insect life could hardly be overlooked. On Moor Plantation, I am happy to say, I have since the beginning of August found nearly thirty species of Myxos, nearly half of which are new African records. The dry season has stopped this work for the present and I have in consequence taken to the insects."

And later in the same letter, referring to the suggestion that he should join the Entomological Society :—

"There is no withstanding Dr. Lamborn, and under his inspiration I may manage to do something which will enable me with less unworthiness to join the Entomological."

Although Lamborn and Farquharson were only together for twelve months, the inspiration of which he spoke remained and grew with every fresh discovery and was strongest in the last year of his life. His original observations in this short period were described in eighty closely packed quarto pages, written between September 9, 1917,

and August 31, 1918 (p. 401), just before he sailed in the ill-fated "Burutu." It is a pathetic thought that these pages in twenty separate letters, and all the packets of specimens illustrating them, should have arrived safely in England while the author was lost.

His consignments of rare and interesting specimens were so numerous that it was suggested that the museum would gladly bear the expense, but he at once replied: "I'll be only too pleased to send at my own charge. I simply wouldn't dream of anything else. . . . I'm practically a non-smoker and a most temperate person too, and I *must* help the revenue somehow. . . . If what I manage to do would help to clear up even a very small point of Lycaenid relationship I'd consider any personal outlay most amply and gloriously rewarded."

Thinking of all that he owed to Aberdeen, Farquharson was anxious to collect examples of butterfly mimics and their models for the Zoological Department of the University; for, as he wrote, they "might inspire some student to do a little as Lamborn did me."

The friend of whom he so continually spoke with gratitude has recalled memories of their year together at Moor Plantation:—

"I first met C. O. Farquharson in the spring of 1913 when I entered the Government service as Entomologist. He had completed his first tour of a year, and had just returned from leave.

"Our laboratories, under a common roof, adjoined; and a community of interest in scientific work soon put us on a very friendly footing. As a worker I found him most indefatigable. It was his practice, almost as soon as day broke, to walk round the experimental farm, searching for and examining fungi of economic importance. During the later official working hours of the day he devoted himself conscientiously and exclusively to the study of material gathered earlier, making microscope preparations, preparing cultures, and reading up original descriptions: for he had a sound knowledge of modern languages. In the early evening, when he might reasonably have rested, or at all events indulged in some physical relaxation, his untiring enthusiasm again led him forth, this time to explore the far wider field of the almost virgin bush near by.

"He was keenly interested in animated nature and from time to time had asked concerning the habits of the numerous insects he had seen. But his first active interest in Entomology was, I believe, awakened by the discovery of beetles in various instars in some of his beloved fungi, the Polyporeae. An examination of some Lamellicorn larvae in the fungi led to a discussion of the habits of the group as a whole, and the natural agencies which might limit the numbers of insects in general. He had not heard of the various parasites, or of the ways of the Fossorial wasps; and a long talk induced us to sit, as I well remember, being very contrary to my fixed habits in the Tropics, well into the small hours of the night.

"Of a romantic nature, he revelled in the study of the romance of insect life, and at about that time I was so fortunate as to throw some light on the value in sexual selection of the wonderful mandibular processes of the Eumenid *Synagris cornuta* Linn [Report, Brit. Assoc., 1913, p. 511]. Thereafter Farquharson vied with me in the study of the Hymenoptera, working still harder during leisure hours, and joining me in my laboratory after the evening meal, so that we could compare and discuss the results of excursions made together on Sundays, and independently on week days.

"The habits of Lycaenidae, the most interesting of all butterflies both as larvae and imagos, then claimed his attention: for I was able to show him various ant-attended and predaceous larvae, and therefrom originated the splendid new discoveries concerning the group with which his name must always be associated.

"Farquharson was a most versatile and widely read man. He had a sound knowledge both of French and German, and was familiar with the Classics, having a pleasing little habit of capping remarks, often in letters, with an appropriate quotation in Greek or Latin. He had in addition that broad general foundation of scientific knowledge which seems so especially to be built up by the teaching of the Scottish Universities, enabling him to turn with equal readiness to the study of the sciences both of Mycology and Entomology.

"His premature loss must be a bitter blow to Mycology, but, as a student of insects realises, especially to Entomology in the African Tropics, for far more investigation, on the West Coast particularly, is now called for to

complete the various researches already initiated by him.

"The additional losses of C. Mason in Nyasaland, and of H. Dollman of N. Rhodesia, workers of promise, both through illness contracted while on duty, are a further setback to the advance of the science, inasmuch as, in spite of the vastness of the British African possessions, the number of enthusiastic workers is so very limited, the Governments not yet being alive, apparently, to the paramount importance of Entomological research.—W. A. L."

In his admirable letter to Dr. A. W. Hill (D.), Farquharson gives, as Prof. Trail wrote to me, "an exceptionally good statement of such work as fell to him and of how to face it," and the letter was reprinted in the "Aberdeen University Review" (E.) because Prof. Trail wished his students to read it.

Farquharson's main object in this letter was to emphasise the essential importance of understanding all that promotes the healthy life of the normal plant, and of looking, in the first instance, to the conditions of growth rather than to the *deus ex machinâ* of a parasitic fungus or insect enemy.

He believed "that every mycologist ought to be deprived of his microscope (and perhaps even of his pocket lens) for at least the first tour of his service, and perhaps for two years, and compelled to raise *normal* crops with no artificial aids of any sort" (D., p. 354).

"The essential remedy" for palms supposed to be dying from the attacks of *Bacillus coli*, he found to be "proper cultivation, growing . . . in the proper place on a proper soil in the proper way, with plenty of light and air" (D., p. 359).

And he was always ready to make fun of an excessive eagerness to rely upon "economic" methods. Thus, when he found, for the first time in Africa, gnats of the genus *Harpagomyia* being fed by *Cremastogaster* ants, he wrote:—

"Our sanitary authorities if they get wind of this, will have out an Ordinance decreeing the destruction of all *Cremastogaster* nests, ranking them with the neglected sardine tin as friends of the mosquito and foes of humanity. I once heard an authority on these matters declare that

on any station of which he had charge, he would never allow anyone to grow a Pawpaw. Did we not know that it was the favourite food of the ♂ mosquito? Starve them then; make them die of inanition and the ♀s not being hermaphrodite and autogenous, would likewise sink into a decline. Alas for the eupeptic pawpaw! Of course, coming as I do from Scotland, I may have failed to notice that he was jesting. But he was (I regret to say) a Scot too, and if one Scot can't tell when another Scot is jesting, who can, I ask?"

Farquharson's years at Moor Plantation during the war were full of anxiety and discomfort. His brother was in the trenches in the Ypres salient and was wounded in October, 1917. One of his leaves home was saddened by the death of his father in 1916. Then, in his last two years there was much sickness in S. Nigeria, although Farquharson himself kept well, a result which he attributed to his out-of-doors study of natural history. Thus he wrote on August 14, 1918:—

"There is not much room for what one might call the higher life. A short evening for tennis and a long one for cards and drinking about sums up the average official's life outside the drab round of the office. Without a decent hobby I don't think I could have stuck this long tour, and it has been a very great pleasure to me to try to fill up some of the few lacunae in Lamborn's work, however imperfectly. I hope I may be able to do more, but I am grateful indeed for the chances I've had to do even a little."

And earlier, in November, 1917: "When I am finding things, really good ones, I must say I never think of the possibility of going sick. The worst that can happen to me here is to have time to worry."

Farquharson considered, contrary to the usual belief, that the "dry season in many respects is not superior to the wet, up-country at least," and that "it is in the dry season that men get run down, although the effects only come out in the wet."

But, however refreshing the rains may be, there appears to have been too much of a good thing in 1917, when he wrote: "I spent the whole of a wet September here. In my bush hut there was only one dry 'island' when it

rained, and that was my camp-bed over which I had slung a ground-sheet. Nice little Hepaticas and graceful little ferns are growing on the mud walls. I think it must have been the fact that I couldn't help laughing at it all, that kept me well. It wasn't official solicitude for my welfare. There were no funds available to buy thatch which, strange as it may sound, is hard to get here. And then I got that wonderful Lycaenid find [p. 393] and one or two others."

Another discomfort was an indirect result of the war—the disorganisation of work in his Department, bringing uninteresting columns of accounts and the management of labour. "I haven't got near my own office the whole tour and am only mycologist in name," he wrote in September, 1917. And nearly a year later:—

"I have been having a most tiresome time doing up arrears of work (not my own) before going on leave. I wouldn't mind doing overtime or interesting work, but what I am doing any native clerk could do, a dreary totalling up of columns of labour expenses in the working of this plantation. I suppose I'll get to know how much it takes to hoe or weed acres of crops (without the aid of any labour-saving machinery and by methods impossible to apply commercially); but how I detest the work! However, the mail took my mind off the dreary business."

And here too, as he wrote on another occasion of the same uninteresting work: "If it weren't for the ants and the Lycaenids I'd be ill off indeed. Man cannot indeed live by bread alone."

The submarine campaign was at its worst on the West Coast, and Farquharson was always full of anxiety about his notes and precious parcels without which his observations would lose nearly all their value. He was continually hearing of disasters, and losses among his friends, and words written in December, 1917, were prophetic of his own fate on the "Burutu":—

"I hear that over twenty Nigerian passengers were drowned off Holyhead, too, almost within sight of home! Another Hohenzollern laurel!"

As in his letter to Dr. A. W. Hill (D.), so, continually in his letters to me, Farquharson referred, with anxiety and evident foreboding, to the submarine menace. Of several passages from his letters already published (C., pp. 141, 142), I here reprint a single one because it is so clearly written in the spirit of a last message. It is very

touching that he should speak as he does of work which gave me quite as much pleasure as it gave him.

"The submarine statistics naturally have most interest for those about to go home. I do hope I may get safely through and back, but if not it cannot be helped. Before I close, however, and in case this might be the last of me, I would like to thank you again for the great and kindly interest you have taken in the little bits of things I have been able to do, not to mention the patience with which you have tried to guide me. I've no doubt if I get no other chance to do better, somebody else will. [Aug. 14, 1918.]."

But he felt, after his long stretch of twenty-three months on the West Coast without a leave, that "three months at home is something worth taking a risk for," and he was longing "for a sight of Scotland."

The memories of survivors, recorded in letters and in "West Africa" for October 12 and 19, 1918, bring before us a vivid picture of a voyage in the Great War. The "Burutu" left Lagos on September 2, a day later than Farquharson had supposed, and reached Freetown, Sierra Leone, on the 7th. Here labour, reduced by influenza, required twelve days for taking in coal, water, etc., and the mails were transferred to the Escort-ship of another convoy. When they sailed on September 19 the "Burutu" was one of nine steamers, including three troopships. The voyage was uneventful until about October 1 when it became very cold and the sea rather heavy. At about this date destroyers met the convoy and took six steamers to southern ports, the remainder being escorted north by one destroyer and two "Mystery" ships.

At about 11.0 p.m. on October 3, cold and wet with a rough sea, the "Burutu," steaming without lights, within three hours of Holyhead, was run down in the darkness by a larger vessel, the "City of Calcutta." Then came a second collision with the same steamer, and this cut the boat clean in two and she sank in eight or nine minutes after the first blow—"lost just as fully through the Germans' unspeakable sea practices as if they had torpedoed her."

Some boats and gear were carried away, others capsized when lowered, and, although the "City of Calcutta" did what she could, it was only possible, in the heavy sea and

intense darkness, to rescue a small proportion of the passengers and crew.

Captain W. E. Potter was on the bridge directing till the last moment when he told the passengers to save themselves, and went down with his ship. There was no rushing about or disorder of any kind although for part of the time after the first collision all lights were extinguished and friends could only recognise each other by their voices.

Mr. A. J. Goodwin, Executive Engineer of the Public Works Department, Southern Nigeria, Farquharson's cabin companion, remembers his high spirits on the voyage and his energy in the deck games, when, with a "brither Scot," he tried to knock spots off the Sassenach. He was the expert on the War, and, with his large maps, most helpful when the daily wireless arrived. With the other passengers he took his share of watches, an hour-and-a-half each, in the danger-zone, and his friend thinks that he was on duty that last evening up to 7.0 p.m. Mr. Goodwin found him just after the first collision getting his coat and life-belt on in the cabin. He was quite cool and collected, and being ready first, was on deck before his friend. Then came the second collision and they saw each other no more. Mr. Goodwin thinks that he may have been in an overturned boat from the keel of which six survivors were rescued after about nine hours. His body was found off the Welsh coast and buried at Aberdeen.

The words of his first great teacher in science are a fitting conclusion to this brief life of an exceptionally gifted and exceptionally well-trained naturalist.

Among the sons of the University of Aberdeen who "have toiled and died in many lands and seas in the service and defence of the British Empire, of freedom, and of the just cause . . . none was of higher promise or gave more faithful service than Charles Ogilvie Farquharson. . . . His personal friends will retain the memory of an earnest, unselfish, and fearless seeker after truth, of great ability, but most free from vanity, ready at all times to help others by deed as well as by word, whose death has brought to them a sense of grievous loss" (C., pp. 138, 140).

A. "Nature." Vol. cii, 1918–1919, pp. 192 and 371 (referring to D).

B. "Alma Mater: Aberdeen University Magazine." Vol. xxxvi, No. 1, December 4, 1918, p. 2. Written by two College friends.

C. "The Aberdeen University Review." Vol. vi, 2, No. 17, March, 1919, pp. 138–143. By Prof. J. W. H. Trail and Prof. E. B. Poulton. Contains a complete list on p. 143 of his Entomological publications in Proc. Ent. Soc., Lond., 1913–1918.

D. Royal Botanic Gardens, Kew, Bull. No. 10, 1918, pp. 353–361. Contains a long letter dated August 23, 1918, from C. O. Farquharson to Dr. A. W. Hill, F.R.S., Assistant Director.

E. Reprint of above in Supplement to "Aberdeen University Review," March, 1919, pp. 193–200.

F. Proceedings of the Entomological Society of London, 1918, pp. clxvii and clxxx.

Introductory Note (E.B.P.).

It will be obvious to the reader that this memoir was never written or intended to be published as a scientific paper. The author wrote hurriedly and freely of the observations which had interested him and the material he was sending. He wrote in the intervals of a very hard-worked life in the Tropics. Had he lived, several formal papers would have appeared, each dealing with a separate subject. But, as this was not to be, it seemed best to analyse the whole correspondence and to group the contents according to the subjects treated of, combining with each an account of the illustrative specimens and a record of the brief accompanying notes. These accounts precede the groups of extracts from letters, and, being editorial, are enclosed within square brackets, as also are any substantial additions to the extracts themselves. Slight verbal changes, to the making of which the writer had freely consented in his lifetime, are not indicated, and it has not been thought necessary to add name or initials to the bracketed words. A single pair of brackets has been considered sufficient to indicate the authorship of two or a few consecutive paragraphs, but when several are included, initials have been added.

In the systematic and descriptive appendix, where the

editorial additions are much shorter and fewer, it has been thought better to add the initials E.B.P. as well as the usual brackets.

The authorship of footnotes in both text and appendix is indicated by initials, except in purely formal editorial notes.

In the frequent references to the Proceedings and Transactions of the Entomological Society of London the abbreviated forms Proc. and Trans. Ent. Soc. have been employed, Lond. being usually omitted.

The great majority of the letters were written at Moor Plantation (p. 326), and this place is to be understood in the absence of any indication at the head of an extract. The only other locality which appears at all commonly is Agege (152 ft.), sixteen miles north of Lagos, where there is a Government farm often visited by Farquharson. The few remaining localities are described when first referred to in the extracts.

The material has been mounted and labelled with the greatest care by Mr. A. H. Hamm and Mr. J. Collins of the Hope Department, and by Mr. H. Britten, formerly of the Department, and I desire to express my thanks for their valuable help in this intricate work.

The specimens may be studied in the Hope Department; also, as regards some of the types, co-types or para-types of certain species, in the British Museum (Nat. Hist.) and in collections of the authors.

It is hoped that the detailed table of contents will be a sufficient guide, and, as regards subjects, an index, to a memoir which is, of necessity, varied and elaborate.

A glance at this table will show how very much has been contributed by the distinguished authorities who have worked out the author's material, and have thus done so much for his memory.

I also wish to express warm thanks to the following eminent specialists who have given the kindest help:—

G. J. Arrow, Maj. E. E. Austen, D.S.O., H. A. Baylis, D.Sc., Prof. M. Bezzi, K. G. Blair, Prof. G. H. Carpenter, B.A., D.Sc., W. C. Crawley, B.A., F. A. Dixey, M.A., M.D., F.R.S., H. St. J. K. Donisthorpe, F.Z.S., E. A. Elliott, F.Z.S., C. J. Gahan, M.A., D.Sc., J. J. Joicey, F.L.S., Dr. K. Jordan, Ph.D., C. G. Lamb, M.A., W. A. Lamborn, G. A. K. Marshall, C.M.G., D.Sc., The Rev. F. D. Morice, M.A., S. A. Neave, M.A., D.Sc., L. B. Prout, Capt. N. D.

Riley, The Rev. Canon K. St. Aubyn Rogers, M.A., Hugh Scott, M.A., Sc.D., Miss Lorrain Smith, T. A. Sprague, O. Stapf, Ph.D., F.R.S., G. Talbot, W. H. T. Tams, and Rowland E. Turner.

Although the present memoir cannot claim the precision and condensation of a formal scientific paper, it is given, by the author's letters, a character and charm of its own. We are often made to feel as though we were present with the writer and sharing all his enthusiasm and delight. For this reason a statement made in an earlier letter is retained in a later one if its omission would weaken the freedom and force of a description.

Furthermore, the author's letters bring home to us more intimately than would be possible in more formal writings the stimulating and encouraging knowledge that one who, at the start, was not an Entomologist, one whose days were filled and overfilled with other work, should have been able to do so much for Entomological science.

A. OBSERVATIONS ON LEPIDOPTERA, ESPECIALLY THE LIFE-HISTORIES OF LYCAENIDAE IN THEIR RELATIONS TO ANTS.

I. LIPTENINAE: INTRODUCTORY NOTE (E.B.P.).

Almost nothing was known of the life-history and earlier stages of the Lipteninae until the publication of W. A. Lamborn's paper in Trans. Ent. Soc., 1913, p. 436. Aurivillius, in "Rhopalocera Aethiopica," gives only two references—(1) to Roland Trimen's brief account and figures of the larva and pupa of *Durbania amakosa* Trim. ("South African Butterflies," vol. ii, 1887, p. 216; vol. i, 1887, pl. ii, figs. 2, 2*a*); (2) to his own paper in Ent. Tidskr. (vol. xvi, 1895, p. 207, pl. ii, figs. 1, 1*a*, 1*b*), describing Sjöstedt's discovery of a larva and two pupae of *Hewitsonia kirbyi* Dewitz on the whitish grey, rather mottled bark of a tree. They closely resembled the bark and were very difficult to find. The description of both stages and the figure of

the pupa show great similarity to several of the Liptenines collected by Farquharson and described and figured by Dr. Eltringham in the present paper. The larvae of *D. amakosa* were gregarious and fed upon a common species of grass, *Anthistiria ciliata*. Numerous pupae were grouped close together, attached by a slight silken web to a rock. Nothing was known of the food-plant of *Hewitsonia*, but it is now certain that the larva had fed upon the filmy lichen encrusting the bark.

Lamborn's paper referred to on p. 337, with Dr. Eltringham's description and figures of *Euliphyra* (*ibid.*, p. 509, pl. xxviii), brought a great advance: for we are here given an account, on pp. 446–457, of the larval and pupal habits of three species—*Aslauga vininga* Hew., *A. lamborni* Beth.-Bak., and *Euliphyra mirifica* Holl., and the pupal habits of three species of *Epitola*, viz. *ceraunia* Hew., *carcina* Hew., and *oniensis* Beth.-Bak. Furthermore all six species are shown to be related to ants—for the first time in the Lipteninae. The larvae of the two first-named species fed upon ant-tended Coccidae, while *Euliphyra* was fed by the ant *Oecophylla*. It is unlikely, however, that such food is primitive in the Lipteninae any more than in the Lycaeninae; and we owe to Farquharson the important discovery, briefly announced in Proc. Ent. Soc. 1917, p. lxi, that bark-encrusting lichens on trees bearing the carton nests of *Cremastogaster* ants form the food of many Liptenine larvae—in fact, with the exception of the grass eaten by *Durbania*, the only larval vegetable food-plant at present known in the whole group. When we reflect that this, for a Lycaenid, extraordinary larval food is common to forms so different as *Teratoneura*, *Hewitsonia*, *Epitola*, *Iridopsis*, and *Citrinophila*, it becomes certain that it is wide-spread among Liptenines, and possibly their primitive food-plant.

In addition to this great increase in our knowledge, Farquharson shows that some of the imagines feed upon secretions of ant-tended Coccids and plant-glands, and even drive away the ants.

Dr. Eltringham's descriptions and beautiful figures (pp. 473–89, Pls. XII, XIII, fig. 3) include not only the fine material sent by Farquharson but much of Lamborn's as well; and, combined with his account of *Euliphyra* (*l.c.*), they give us a wide survey over the earlier stages of this most remarkable group of butterflies.

A. Teratoneura isabellae Dudgeon.

[Farquharson's first *Teratoneura* was a female taken at Moor Plantation, Dec. 12, 1913, in the act of drinking the secretion of ant-attended Coccids on a twig near the Apocynaceous *Cremastogaster* ant-tree *Alstonia congensis*, on which larvae and pupae of the Lycaenid were afterwards found. The following letter was written to his friend W. A. Lamborn, the others to me.]

Moor Plantation.

Dec. 24, 1913.—In response to your request I am now sending you a few notes on the Lycaenid which I brought in on the 12th of this month.

About six o'clock in the evening I happened to pass the tree on which you had some time previously shown me some ant-attended Coccids. I was rather surprised to see a butterfly evidently in the act of sharing with the ants in the fluid provided by the Coccids. At the time, the Lycaenid was hanging from the underside of the twig with the wings outspread. Being unprovided with a net, I had to adopt the only other method possible, to catch it. Fortunately, owing to its intentness in supplying the wants of Nature, or to its natural "protectedness"—for even in the falling light it was by no means inconspicuous, I secured it easily with my fingers, and was pleased indeed that you regarded it as quite a prize.

Feb. 18, 1914.—I received the letter with the great news of *Teratoneura*, last mail, which pleased me very much indeed, but I hasten to explain that its ever having reached the Hope Department is due in the first instance to Dr. Lamborn. From the note which I made at the time of finding it, you will readily perceive that it interested me primarily from its being found in the act of sucking up a Coccid secretion. This was a new thing to me, though, of course, not to my friend. He told me so, but went on to congratulate me with considerable solemnity, so that I felt rather awed and inwardly congratulated myself that the creature had been so intent on its meal that I, without a net, and absolutely innocent of its possible identity, yet managed to catch it by the precarious method of the finger and thumb.

I wonder if any of us will ever penetrate the secret of the larval *Teratoneura*.

1. *The Life-history of Teratoneura.*

[The bred series of *Teratoneura*, illustrating the following sections, includes 8 males and 9 females from larvae on the bark of, or pupae on or near, the "ant-tree" *Alstonia*, already mentioned. The first, a male, A, which emerged about Dec. 9, 1916, at Agege, where Farquharson happened to be at the time, and the second, a female, B, emerging Feb. 15, 1917, are accompanied by their pupa-cases of which one, the male, is represented on Pl. XII, fig. 9; see also p. 477. The remaining 15, emerging Feb. 24–March 8, 1917, are also indicated by letters for their respective pupae, but these were never received, although two parasitised pupae were sent (p. 459) together with two spirit specimens of the extraordinary larva described and figured by Dr. H. Eltringham (p. 476, Pl. XII, figs. 7, 8, 14, 15).

The pupal period of one female was 10 days—pupation Feb. 14, emergence Febr. 24.

The following notes on 8 specimens indicate that emergence usually takes place about noon or within the 2 or 3 hours after it: ♀ before noon; ♂ about noon; ♀ a little after noon; ♂ about 1.0 p.m.; ♂ after 1.0 p.m., probably about 2.0; ♀ 2.30 p.m.; ♂ after 2.0 p.m.; ♀ p.m.]

Feb. 22, 1917.—I send you two butterflies with their pupa-cases. One I got just before going to Agege in December. I had to take it with me and it emerged there. I have seen no more of them till lately, when I have secured about a dozen pupae which I now have. Very likely Lamborn has sent them before, but they are new to me. I send one authentic larva which I put into spirit yesterday. When alive it is very Lymantrid-like, with bright colours and spots. The pupa is a "decayed"-looking thing, like a mouldy object of some kind, till it is closely examined, when it is wonderfully fine. When the first butterfly emerged I thought a Skipper had got in by mistake. The resting position is very Skipper-like. I have now seen quite a number of larvae of which I will write to you more fully later. This is simply a hurried foreword. They have legs like *Hewitsonia* larvae and run about among the ants in the same way—*Cremastogaster* as before.

May 18, 1917.—I got the great news that it *was Teratoneura* that I'd got hold of after all. I am sending you the rest this mail and hope to send their pupa-cases and one

or two parasitic Chalcids next mail. I'll be so vexed if submarines get this lot. I'm really nearly afraid to send at all, but the wet season is setting in and things are apt to spoil if kept. I will answer all the points you raise in detail next mail, which will be in about a week, I think, for I cannot get time just now. It was indeed very odd that I should find the *Teratoneura* first and re-discover it even to its larva. I may say that the larvae that I had feeding were all definitely of the species, no question whatever.

I am especially pleased about the *Teratoneura*, because I really knew what I was after and managed to do it. Of course it would never have happened but for Lamborn, and it is so very kind of you to take so much trouble over it all.

2. *The Larva of Teratoneura.*

[The Lymantrid appearance of the larva was very evident in the spirit specimens and is shown in Dr. Eltringham's figure (Pl. XII, fig. 8; and the description, p. 477; see also p. 342). It is also the fact that *Teratoneura* is the only butterfly larva yet known which has the urticating type of spicules, although their effect has not been observed. Mr. W. A. Lamborn happened to be at home when the larvae arrived; he recognised them directly, but said that he had always mistaken them for moth larvae.

On Dec. 25, 1917, Farquharson bred the Lymantrid moth *Naroma signifera* Walk. from a larva on the Apocynaceous tree *Alstonia congensis*, on which *Hewitsonia*, *Teratoneura*, and other Liptenine larvae were found. The specimen was referred to on Jan. 26, 1918, in the following passage, in which "*Hewitsonia*" was probably written for "*Teratoneura*," although the former also appears on the notes accompanying the specimen: "The moth with the *Hewitsonia*-like larva is rather interesting. The larva is very like a *Hewitsonia* larva and lives on ant-trees (I have only, however, found two, and of these one was accidentally destroyed). It has two glands, in the mid-dorsal line on segments 9 and 10, protected by spines. Hardly any cocoon is spun—simply a few threads—and the cast skin is left hanging near the pupa." Further specially directed observations will be required in order to test the conclusion that these larvae always feed on ant-trees and are the models of *Hewitsonia*, *Teratoneura*, or other Liptenine larvae. *Naroma signifera* is an extremely abundant and

wide-spreads pecies, bred in large numbers by Lamborn at Oni and by Carpenter in Uganda, and ranging to Natal. The two mid-dorsal glands are characteristic of Lymantridae.]

March 1, 1917.—The larvae are very remarkable, being very hairy, and, on the naked parts between the tufts and bands of hairs, brightly pigmented with red, green, yellow, and perhaps other colours—such colours as one associates with Lymantrid caterpillars. The larva is more moth-larva-like even than *Hewitsonia*, though of the same general character, even to the little "sucker" that is found on the outside upper edge of the pro-legs [pp. 352, 355, 383, 485], which is retracted when the foot is lifted and exserted when it touches the bark of the tree or whatever the larva is walking upon.

3. *Teratoneura Larvae and Ants.*

March 1, 1917.—The fact recorded in the last paragraph [of the section on Pupation, p. 346] led me to look for evidence of attacks by the larvae on Coccids, but with entirely negative results. Except when about to pupate they are never found on leaves nor among the Coccids. Up and down the stems of the two big trees a busy column of ants in loose formation about 5 to 8 deep is constantly running. They do not appear to stop night or day, for I have gone down after dark to see if the larvae could possibly be night-feeders. I have seen several larvae on the way to pupate wandering down the column in a leisurely way; ants coming in the opposite direction turn aside, those coming behind keep a respectful distance. There is no hostility shown, nor yet friendly attentions such as mark their behaviour to possessors of Guenée glands. It is really extremely difficult to get the larva to leave the ant-column. I have pushed them away, but they persistently return. A tiny twig intruded among the ants is immediately attacked.

4. *The Larval Food of Teratoneura.*

March 1, 1917.—I haven't seen any of them feeding so far, as I have seen *Hewitsonia* larvae, at least apparently feeding. I think they feed high up the tree, but I have examined the frass microscopically and am to send you a specimen or two by this mail [not received]. It is a mixture of vegetable débris of a very odd kind, little bits of tissue, I think cortical, largely sclerenchymatous in one or two smears I have made—I got a fine bunch of store-cells in one, fungus

spores mainly referable to phaeosporous Hyphomycetes, hardly two spores being alike, just such a collection as one could scrape off a bit of "clean," living bark (that is not decayed); very little fungus mycelium—so far as I have yet seen—except fragments of brown-coloured hyphae; numerous Algal elements, not filaments but sporing or resting stages. I am on the whole inclined to believe that they are lichen-feeders, but I intend to go into the question more fully, for *Hewitsonia* larvae are now beginning to appear. I am also to compare frasses of different larvae of known food-plants. If they were bark-feeders there would be a larger proportion of undigested cortical matter. Algal filaments would probably be more numerous instead of only sporing stages. I am inclined to think that the fungus constituent—at least hyaline mycelium is digested. Resting brown mycelium might escape. At the moment I am ashamed to confess that I do not remember whether any group of lichens has a brown mycelium.* Brown spores are common enough, but I have an idea that the thallus is always hyaline. I will look up De Bary to-morrow. I remember at the time I found the *E. honorius* larvae [pp. 351–53] that some of their frass left in a jar, the walls of which were moist, formed centres for the growth, a vigorous growth, of filamentous Algae. Perhaps you may be able to induce some Algologist to try the experiment with the frass which I send you. If I lived in a forest district I'm sure I could quickly settle the point, but I feel rather confident of clearing up a good bit of the problem here.

Yesterday I liberated two (immature) of the hairy Lycaenid larvae [*Teratoneura*] after starving them for 24 hours. I put them in the ant-track on the bark of the tree. They appeared to start feeding at once, and

* Miss A. Lorrain Smith has kindly written on this subject:—"Some few lichens have brown mycelium, but that is rather rare. What is almost universal is the brown under cortex and rhizinae of larger forms and the dark brown hypothallus of crustaceous species—the latter not so frequent.

"Bark lichens are a very favourite nidus for parasitic fungi. I often find very flourishing brown mycelium—stout hyphae—pervading the lichen fruits. There are crowds of minute fungi parasitic on lichens.

"The brown mycelium might thus be very easily explained as part of the larval food and may be either fungoid or lichenoid in origin."—E.B.P.

the ants simply walked round them. I then cut off a piece of the bark and enclosed the larvae in a perfectly clean tin. This morning I found fresh frass. The food material is about the most unpromising stuff I've ever seen.

March 18, 1917.—I have a nice series of the Lycaenid with the Lymantrid-like larva. There is no question about their not being carnivorous, nor leaf-eaters, nor flower-eaters, but cortex-feeders. I have not yet cleared up what part of the cortex it is of which they are specially fond. I am inclined to the lichen theory still, for I now know of two trees of distinct Orders on which the same larvae occur, one a *Ficus* (Moraceae, Tribe Ficeae), the other an Apocynaceous tree which I believe is *Alstonia congensis* (author's name [Engler] I do not know at present, but I will find out). Now these two Orders are widely separated, but have one thing in common—latex. But the larvae live on old bark and it cannot be the common factor, latex, that they are after, for they would have to do what a Bostrichid beetle could hardly do, and, as a matter of fact, it takes a good deep cut on old cortex to draw latex. The marks of their mandibles even when one sees them feeding are not visible to the eye, and what they take off must be a very thin layer indeed. The lichens on these trees are of the extremely thin crustaceous variety—so thin that they simply look like different coloured portions of normal cortex, and that makes observation all the more difficult.

5. *The Larval Food of Liptenine Allies of Teratoneura —Epitola, Hewitsonia, Iridopsis, Citrinophila, Eresina.*

Feb. 26, 1916.—I am practically satisfied that the whole group with hairy larvae, *E. honorius*, *Hewitsonia*, *Iridopsis* [including almost certainly *Citrinophila* and *Eresina*], feed on Algae or lichen on the bark of the trees on which they occur. I've examined frass of *Hewitsonia* and *honorius* too. However, I will I'm sure be able to confirm it next tour. The *honorius* larvae, as you received them, were shrivelled a bit, but in life they were exactly similar to Hewitsonias, so much so that I thought their brown colour as distinct from the mottled greyish-green of the *Hewitsonia* larva was a cryptic variation, as they were on a tree with brown bark.

March 18, 1917.—I am certain that *Hewitsonia* is of the same type as *Teratoneura*. Curiously enough I have seen

a *Hewitsonia* settling on the aerial rootlets of the *Ficus* on several successive nights lately. The *Epitola honorius* larvae are also, I am sure, of the same kind, and indeed their shape is exactly that of the *Hewitsonia* larvae, though their colour is brown, a snuff-coloured brown with plenty of hairs, giving them a moth-larva-look. The *Hewitsonia* and *Epitola* larvae are also alike in being rather broader anteriorly—with a square-shouldered sort of shape, as it were—than posteriorly. This is not quite so marked as in the *Teratoneura* larvae, but, now that I know a little about them, I would have no hesitation in associating them with Lycaenidae, and with each other among the Lycaenidae, if I saw them on ant-infested bark, the ants being *Cremastogaster*. The little Lycaenid [*Epitola concepcion* Suff.] that I sent, with the hairy larva and *Hewitsonia*-like pupa, is, I am certain, of the same order, as also is *Iridopsis*. I found at least three other larvae among ants of the same type last tour in travelling through a forest district, but couldn't do anything with them, as they were too young. I do wish I could get a month's holiday in a forest district, and I'm nearly sure I could work out as many of this type as Lamborn did of the others. It is rank bad luck being here for such work. I am very curious to know the systematic position with regard to each other of those I have just mentioned. Are they really closely related or is it a case of convergence? [They are certainly nearly related.] I have an idea in my own mind that this group of Lycaenids in a sense correspond to certain xerophytes of the plant world. A desert plant if put into competition with ordinary trophophytes and left to make the best of it is choked out by its better adapted rivals and perishes in the midst of plenty. In the desert it thrives in apparently starvation conditions, but the little there is is enough for the few that can stand the conditions. We can hardly imagine even Germany making war on the Eskimos, to use another analogy. It may be so with this group. What with poor fare and the ants, probably few insects would care to invade their field. One could imagine Satyrines being left to starve through an invasion of Army worm or Locusts.

Dec. 29, 1917.—The hairy, "eremobiotic" types, that live in a desert of ants, neither tolerated nor attacked but simply ignored, giving nothing and taking nothing of any consequence to the ants, though securing indirect pro-

tection, the Hewitsonias, Teratoneuras, etc., have of course quite visible heads. I use the word "eremobiotic" to express this insect counterpart of the desert "xerophytic" plant. Synoekete implies a more intimate relation, more applicable, is it not, to guests (welcome or not) living *inside* the nests? Perhaps eremosymbiont, if that is a legitimate coinage, fairly nearly expresses the idea. Wasmann, according to Wheeler, uses the term trophobiosis to describe the more common relation of the Lycaenine Lycaenids. In a "trophic" classification of Lycaenidae the two terms contrast fairly naturally. They cannot be ranked with the scaffervying * neutral synoeketes, and I'm sure to most insects the "playing field," of a *Cremastogaster* colony especially, is a veritable desert. In case such a term were too particular, implying absolute proof rather than the more or less hypothetical, atrophic and syntrophic symbiosis is perhaps a better general description.

6. *The Pupation of Teratoneura.*

March 1, 1917.—The larva pupates either on a leaf or on a slender dead twig or dead herbaceous stem on the tree or round its base. The trees on which they are found throw out numerous very slender aerial roots, which hang down from the stem and branches. These are favourite pupation places. When these end in the air and not, as they sometimes do, become re-attached to the parent tree lower down, ants do not generally run down them. Such a place would be relatively safe at the critical, vulnerable period of transition. *Argiolaus* pupae are generally to be found on shrubs or herbs at a little distance from the ant-tree, and when, as happens at times, they pupate on a plant too near the tree, the pupae are frequently devoured by the ants which respected them or even protected them as larvae. But the *Teratoneura* almost as frequently as not pupates on a leaf with the base of its stalk within an inch of Coccids and ants.

7. *Teratoneura Pupae heavily parasitised by Chalcids.*

Feb. 22, 1917.—I notice that the pupae are heavily parasitised by Chalcids, and I cannot say I have ever seen a parasitised *Hewitsonia* of a good many seen by me now.

March 1, 1917.—I think I remarked on the frequency with which this species is parasitised, a very tiny Chalcid

* "Scaffery" is defined in Murray's Oxford Dictionary as—"Extortion, extortionate taking of perquisites."

and a much larger one being the culprits. [For the species and numbers see p. 459.] I have seen many *Hewitsonia* pupae, old ones on trees besides those I've bred out and let away, and do not remember having got one parasitised. I have been in the way of breeding them out as I found them and letting them away without keeping records, but I intend to look into the question of their parasitism more particularly now. *Hewitsonia* larvae are protected by the ants (unconsciously, for they give no return) and also by their cryptic coloration both as larvae and pupae. The larva of this other species [*Teratoneura*] is brightly coloured. It asks for trouble, but no doubt is partly protected by the ants, as is *Hewitsonia*. As a pupa it has succeeded very well in looking like nothing in particular—a valuable disguise I should think, but it is at this stage that it is attacked. I saw a tiny Chalcid on one, one day.

8. *Other Enemies of Teratoneura.*

Feb. 28, 1917.—Just underneath that passage in Shelford [p. 350] the subject of birds eating butterflies is mentioned. I may say that under these trees I have seen one or two butterfly (the Lycaenid) wings that may have been the remains of a bird meal.

March 1, 1917.—By the way, I saw a large green Mantis with the remains of a larva one day, but it had left the ants and gone on to a leaf to pupate. Of that I feel sure, for, as it happens, the small stump with its suckers is haunted by one or two Mantises, but they do not go on to the stems among the ants. It may be, however, that the imago wings I saw on the ground were the work of a Mantis.

9. *Teratoneura Imagines feeding on Secretions of Ant-attended Coccidae and driving off the Ants.*

Feb. 28, 1917.—I have had further opportunities of studying the butterfly of which I sent you two specimens last mail, the one with the hairy Lymantrid-like larva. I find that the species appears to haunt the tree on which the larvae are found. By the way, it is just beside the place where I found the *Teratoneura* in Lamborn's time (see p. 339). I am wondering whether I can possibly have hit on that form again, for this species appears to specialise (in the adult stage) in Coccid secretions as food. On this point I have one or two observations to send you which may be of interest. One or two points are rather extra-

ordinary, but I have taken great care in the matter and I do think my interpretation of what I saw is fairly reasonable. Let me first explain the conditions. Two trees of the same species (which probably belongs to the Apocynaceae) had grown up together, but, in partially clearing the land, one was cut down to within a foot or two of its base, and the other was left. From the stump of the one cut down a large number of sucker shoots have sprung, the tips of which are just about 6 feet from the ground. The ends of the lateral branches are nearly all being sucked by Coccids, all of which are ant-attended. Both the big tree and the stump are wholly over-run by ants, though their main habitat is in the big tree and in another of the same species about 6 feet away. They do not have a carton nest, but appear to live in holes in dead branches, though this I have yet to verify. There is a constant stream of ants up and down the trunks of both the big tree and the stump too. About a week ago, on Thursday evening, Feb. 22nd, to be exact, I was trying to find out what the larvae might feed on, suspecting the Coccids as their prey, for pupae are very commonly found near them—often indeed on a leaf of the twig they are sucking. Suddenly I noticed one of the butterflies alight on a twig, as I thought, perhaps to oviposit. It remained for a few seconds and then flew off, circling rapidly round the stump, soon to alight again. It lit on a branch with ants and Coccids on it, and I felt sure I was to see what I've not so far been lucky enough to witness—a Lycaenid ovipositing. I suppose my anxiety to see this prevented me "tumbling" to what really was doing. The butterfly lit just at the tip of the branch, the Coccids being about an inch behind that. It proceeded to walk backwards rather slowly and deliberately, the abdomen inclined upwards at a fairly steep angle to the thorax, and the wings opening and closing fairly rapidly though not by any means nervously or excitedly—and gently beating the twig. The ants retreated backwards, making hardly any resistance at all, though some dodged to the underside of the twig and ran forwards. The butterfly having gone back about three inches then suddenly dropped the abdomen so that it rested on the twig and ran rapidly forward, the tip of the abdomen brushing the twig as it did so. The backward manœuvre was repeated, this time on the underside of the twig, the wings then hanging downwards, the

abdomen flexed as before. I was still waiting for the egg-laying marvel. I thought I was to see it to some purpose, when "she," if that really was the sex, let the abdomen rest on the twig. But Lamborn used to swear that females that really wanted to oviposit and knew that one wanted to know the food-plant, really did that to annoy the onlooker: so I kept on hoping, till "she" suddenly stopped over the Coccids, unrolled a very slender proboscis and proceeded to absorb the secretion so much prized by the ants. Occasionally an ant would venture along, but retreated without attacking. In a short time the butterfly flew away, circled round for a bit and came back to another twig, where the same performance was repeated. By this time I had formed the conclusion that she was deliberately hustling the ants off what they doubtless regard as their own particular prey. What exactly is the "force majeure" to which the ants yield I do not know; the flapping of the wings isn't a very formidable thing, but it seemed to act and the ants did keep their distance. [The movements described and the position of the abdomen suggest strongly that the butterfly produces and fans towards the ants some odour disliked by them.] I tried the effect of interfering with their lawful preserve by "tickling" the Coccids with a thin grass stalk. Soldiers and workers immediately seized it and held it fast enough to let it be suspended in their jaws when I let go. They had all the appearance of being most justly indignant. I saw the butterfly repeat the performance three times. The performers were only about one foot from my eyes and were not the least bit shy. I failed to catch the leading performer. It was one with the light, predominantly red, underwing. Now I know that nearly every twig of the big trees has Coccids and ants on it, for I got a ladder and looked at some of the lower branches. This evening, about 6.15 p.m., from the ground I counted on the nearest branch of one of the big trees eight butterflies, all busy on the ends of twigs.* Yesterday evening I saw several, and with the aid of the ladder satisfied myself that they weren't merely hung up for the night. I won-

* *Dec.* 24, 1917.—*Teratoneura* nearly always settles on branches well above the ground, and these branches are always scale-infested. I have never seen them alight on low herbaceous plants, or on the ground—and I'm sure I could see a dozen any day I like—rather luxurious entomology, is it not?—C.O.F.

dered if they were night- or dusk-feeders, and have gone down twice at noon to have a look. The Harmattan is on here just now, and it is extremely hot and dry. In such weather *Monomorium* becomes a dreadful nuisance in its search for moisture, and at mid-day most open-country insects are fairly quiet and seek the shade, but this particular Lycaenid appears to be very active just then. They are very rapid fliers and may be seen, some chasing each other round the branches or in the open near the trees, while others occupy tell-tale positions on the twigs. I wonder if this habit of "tapping" Coccids is confined to open-country forms in districts of rigorous dry seasons and scarcity of water. But now I am on dangerous ground. Peradventure I may be numbered in that "vast majority of collectors and field-naturalists [who] are poor philosophers," * or in that other equally melancholy crowd of "zoologists [who] are sorry failures when it comes to observing the living animal in its natural surroundings." † But I do lay the flattering unction to my soul that I am not a "collector."

10. *Other Liptenidae—Epitolina, Mimacraea—with Habits similar to those of Teratoneura as described in the last Section.* [A few weeks after the observations recorded on pp. 347–350, Farquharson observed and sent the much smaller Liptenine *Epitolina dispar* Kirby, "as a specimen of a Lycaenid with the same (adult) habits as *Teratoneura*." The butterfly bore the following note: "March 15, 1917. Small Lycaenid observed driving away ants from plant-gland, to suck secretion. Habit similar to hairy larva Lycaenid [*Teratoneura*], only probing plant-gland" instead of Coccid secretion.

On Dec. 14, 1917, three *Epitolina dispar* were captured, together with one male *Mimacraea fulvaria* Auriv. "Drinking plant-gland secretion on Coccid-and-ant-infested plant" is the note borne by one *dispar*, and a shortened form of the same by the others. The *Mimacraea* has in addition, "Captured at Ibadan in act of drinking secretion." On hearing that this latter was a Lycaenid Farquharson wrote, April 28, 1918: "I was astonished at the Acraeine Lycaenid mimic. I would give something to breed it out. I saw several of them at the same place, and it never entered my head that they were Lycaenids at all. I would never doubt mimicry after that."]

* "A Naturalist in Borneo," R. Shelford, London, 1916, p. 207.
† *Ibid.*, p. 208.

B. Notes on the Life-history and Larval and Pupal Affinities of Hewitsonia, Epitola, Eresina, Iridopsis and Citrinophila.

[In the following section a number of interesting notes from Farquharson's letters are arranged in order of dates. The material on which the conclusions were built may be inferred from the following list of specimens now in the Hope Department, remembering that Farquharson observed far more than he collected, sometimes, as he tells us, breeding out these butterflies and letting them go. *Iridopsis* and *Citrinophila*, considered in the two succeeding sections, also form part of the material on which the following notes were built. It must be remembered that in the earlier notes "*Hewitsonia*," as used by Farquharson, includes three species of *Epitola—hewitsoni*, *miranda* and *honorius*.

Hewitsonia similis Auriv.—Two males bred at Agege, Oct. 9 and Oct 11, 1917. Both larvae and pupae were found in this locality on the bark of *Antiaris africana* Engler—at Moor Plantation on that of *Alstonia*. The pupa-cases were not sent.

Epitola hewitsoni Mab. (Farquharson's "*Hewitsonia*, New Series A.")—One female, somewhat deformed, bred at Agege, Oct. 19, 1917. The pupa was found, Oct. 16, attached to a leaf, probably near the ant-tree *Antiaris*. The pupa-case was not sent.

Epitola miranda Staud. (Farquharson's "*Hewitsonia* B. type.")—Two females both bred Jan. 27, 1918. Both larvae and pupae of this species were found on the bark of *Alstonia*. The pupa-cases were not sent. Lamborn also obtained four examples from the same locality in 1913, and, curiously enough, all are females. The larva of one was found Oct. 26, pupation took place Oct. 28 and emergence Nov. 6. The other three were captured July 10, Oct. 31 (on stem, feeding on Coccid secretion), and Nov. 6 (10.0 a.m. on blade of dead grass). The only male of this species in the Hope Department is from the S.W. of the Victoria Nyanza (Proc. Ent. Soc., 1918, p. xciii). In the British Museum there are 2 ♂ 3 ♀ (3 ex Coll. Staud., 1 ♀ W. Vict. Nyanza, 1 ♀ W. foot Mt. Elgon); at Tring—6 ♂ 1 ♀ (all Sierra Leone); at Witley—2 ♂ (1 Sierra Leone, 1 without locality).

Epitola honorius F.—One female, deformed, bearing the note: "*Hewitsonia* sp. with brown larva, found at Shagamu.

Pupn. about 8.ix.15 while travelling; emerged 19.ix.15." The pupa-case, attached to a piece of bark, was sent (Pl. XII, fig. 16, p. 475) together with 3 larvae in spirit (Pl. XII, fig. 17, p. 475). The larvae were found on an ant-tree and others believed to be the same on a similar ant-tree at Agege.

Epitola concepcion Suff.—One female with the following note: "Larva found resting prior to pupation, 10.i.17. Pupn. completed next day; emerged 19.ii.17." The larva was found on the bark of *Alstonia*. The pupa-case was sent, but one of Lamborn's is shown on Pl. XII, fig. 13.

Eresina corynetes Gr.-Sm.—One female found on the bark of *Alstonia*, Jan. 17, 1918. Referred to in a letter of Jan. 26, 1918:—"The small Lycaenid—captured from the *Hewitsonia* tree. I took it because it was slightly malformed. I have an idea that it had not long emerged, but couldn't find a pupa-case."—E.B.P.]

July 26, 1915.—The mail as I said came on Sunday, and I had one from Lamborn too. I always go out into the bush on Sunday if it doesn't rain, and that day was no exception. I always visit the Lycaenid trees here. Lamborn told me to look out for a *Hewitsonia* larva, and I have in spirit here what I believe to be one.

Sept. 28, 1915.—I now know the larvae of *Hewitsonia*, but haven't yet solved their food problem. But in my three weeks' trek I saw them on every ant-tree I met. The larvae run about among the ants, which do not touch them. I will send specimens next mail if I get a chance.

I also got larvae of identical form [*Epitola honorius*] but of dark brown colour on an (*Cremastogaster*) ant-tree, but of seven only one pupated and the imago is deformed. I found the larvae in forest at a town called Shagamu, which is about two or three days' trek (about 50 miles) from Epe (N.W.): I've not seen them here.

The pupa of the one here at Ibadan [*Hewitsonia similis*], if pupation takes place on a green plant, is coloured more dominantly green than those that go up on bark. I'll write them up more fully, however, later. At present I haven't the time. On the larval feet (pro-legs) are what appear to be glands. I have seen them crawling over a glass lid. They may be found on other larvae of Lepidoptera. They do not appear to secrete. They are on the outer side of the foot, rather like this. [Sketch in letter. See pp. 342, 355, 383, 485.] I think the part is retractile. I think

they are lichen-feeders, but I intend to examine the frass. They won't feed in captivity.

The *Hewitsonia* larvae, by the way, are in no sense ant-attended. They keep in the track of the ants and rest in crevices in the bark quite near the nest. The ants do not heed them. I think they are protected by their hairs and bristles. The ants unwittingly protect them from other foes.

Nov. 24, 1915.—I was so astonished at the Shagamu, one being an *Epitola* [*honorius*]. The larva in form is exactly the same as that of the *Hewitsonia*; only the brown colour is different. They look more like moth larvae. I send you one or two which are unfortunately not normal in size and aspect. I found seven at Shagamu which looked as if they might be about ready for pupation, so I put them in tins with fixed bits of bark for transport as I had to keep travelling, but only one pupated. The rest tried and failed, so that they are little more than skins. I am to send next mail one or two good *Hewitsonia* larvae [not received] and you will be better able to judge their characters; so far as I can make out Lamborn never saw the *Epitola* [*honorius*] larvae.

The *Hewitsonia* larvae are never attacked on the tree, but in a small tube where free movement was prevented, one of several enclosed ants got in between the hairs and proceeded to bite the larva to its great distress. I think they are night-feeders, for in the daytime they are quite passive.

I am so curious to hear what the relationships of the Hewitsonias and Epitolas are. The Shagamu *Epitola*, with its brown larva, in its larval stage is as like to a *Hewitsonia* larva in characters, down to the foot "gland," as any two larvae with different colours can be. They are not like any other larvae I know. As a further point I may mention that several *Hewitsonia* larvae exactly the same in colour as these here, occurred on the same tree with the *Epitola* brown ones at Shagamu. I got some of the ants, but they moulded extremely badly and got destroyed, but the ant is almost certainly the same as the one on the tree here—a small *Cremastogaster*. On a tree at another place on the same trek I saw a *Hewitsonia* larva on a tree associated with a *Cremastogaster* of about the same size, but with a reddish-brown abdomen. [The ant is probably *Crem. buchneri* Forel, r. *clariventris* Forel,

found associated with the larvae of *Lycaenesthes* sp. ? *alberta* Beth.-Baker by W. A. Lamborn. Trans. Ent. Soc., 1913, p. 476.]

Feb. 26, 1916.—*Hewitsonia* larvae are not to be found now. However, we've had the first tornado of the year and the rains are about to resume.

Government Farm, Agege.

Dec. 15, 1916.—I am almost positive that, on a tree nearby that bears a large *Cremastogaster* carton nest, a few larvae (young ones) crawling thereon are those of the *Epitola* I found in Shagamu last tour [*honorius*], which mimics, I think, *Planema epaea*. I'll try to farm out the rubber business till one or two mature. They are mixed with *Hewitsonia* ones and possibly an *Iridopsis*. I will send you some frass for microscopic examination as soon as I can. But what a pity that I get so little time in high forest districts, for it's there that the carton nests abound, and I'm positive that I could do a lot to clear up a number of very interesting life-histories. I will do what I can here, but the whole place has been cleared to make cocoa farms, and nests are few and far between.

Moor Plantation.

Feb. 22, 1917.—I have been long in following up my last letter for two reasons, first because I did not have any luck at all with the *Epitola honorius* at Agege. . . . I got one larva to pupate and lost it, the ant *Monomorium* being responsible. I had watched daily several larvae that were coming on nicely, but they always disappeared and I failed absolutely to find the pupae. I'm not sure that they succeeded in pupating. I saw several new broods, but either they went too high up the tree or they were destroyed by some enemy.

I did find one enemy which I am sending by to-day's mail. I saw it actually attack a medium-sized larva and kill it. To do so—it is a Reduviid bug [*Sphedanolestes* sp., with the note "Agege, Dec. 17, 1916. Reduviid preying on Lycaenid larva"]—it had to dodge about among the ants, but it managed that all right. I hope to get back to Agege in the wet season and may remain there a month, when I hope to do something.

I think the tree on which the larvae are found is the same kind as the one (in the Gambari district, about

24 miles south of this) on which I got the curious little Diptera last tour [p. 444]. You may recall my description of their curious larvae, which wandered about freely among the ants. I did not find them, however, at Agege. I do not know the species of tree, but it is habitually inhabited by ants, and always carries large carton nests.

[The following note in the same letter refers to *Epitola concepcion* Suff.] I have also sent you another little Lycaenid with a very *Hewitsonia*-like pupa-case. I bred it out from a larva (a hairy moth-like larva too) which I found about to pupate on Lamborn's old *Hewitsonia* tree [*Alstonia*].

March 18, 1917.—I must say the *Epitola honorius* pupa-case more closely resembled the *Hewitsonia* than either of them resembles the *Teratoneura* and yet the poise of both is not unlike, though the two former have a much broader attachment than the latter. In fact, I think that except for the colour of the pupa (and in *Hewitsonia* at least it varies a little to harmonise with the background) which is rather darker in *Epitola*, I should find it hard to tell one from the other.

All the larvae have the little protrusible process on the outer side of the pro-legs (one spirit specimen of *Teratoneura* shows these exserted), but so also have the *Pterocarpus* larvae [Lycaeninae, see pp. 383, 485, &c.].

Agege.

Oct. 18, 1917.—I have also sent two *Argiolaus* and two *Hewitsonia* from a tree here in Agege on which I got the very tiny Lycaenid of which I told you last mail, which duly emerged. I am waiting for a large mail steamer to carry *it* home. The tree is a tall buttressed one of the Apocynaceae family, I think [it is the Moraceous *Antiaris africana*], but all round the base I found fallen *Loranthus* corollas of a different species from the one on which I got the Lycaenids at Ibadan. There is, of course, a *Cremastogaster* nest rather beyond my reach. I took in the *Hewitsonia* pupae for a special reason. I was to put you a query about them and found you had put it to me in slightly different form. Of that I will say more. I, as a matter of fact, was to suggest that the *Hewitsonia* larva was rather variable, and was to promise to look into the question closely.

Moor Plantation.

Dec. 24, 1917.—I went down again in the afternoon (Sunday) of these great events [Dec. 23. See Proc. Ent. Soc., 1918, p. xxxii–xxxv]. It is worth something in the conditions in which I have to work at present, to know that at almost any spare moment in daytime I can go down feeling tolerably certain that if I choose I can see such things as *Teratomeura* larvae, just for the trouble of going to the particular tree, or *Hewitsonia*, or—a great many other things. As I was looking out for opportunities for catching the myrmecophilous Diptera on the stem of the *Funtumia*, a *Hewitsonia* actually came along (it was then about 3.30 p.m.) and laid two tiny ova in the track of the ants. It was done with such rapidity that I had difficulty in locating the tiny ova, and the ants didn't seem to suspect their presence either, or, if they did, took no notice. The ova were pale yellow in colour. It is extremely unusual to see *Hewitsonia* on the wing. I have often wondered if they are night-fliers, though it may be that they fly around tree-tops.

Jan. 26, 1918.—By the way in the proof of the Lycaenid notes you refer to "the genus to which *Epitola honorius* belongs." * From the larvae I would have sworn they were Hewitsonias, adapted in colour to the brown bark of the tree on which I found them. They were as alike and more so than the *Loranthus*-eating larvae of *Argiolaus*.

Feb. 8, 1918.—Mail day. The box I have sent is not so interesting nor so complete as I'd have liked. I have mislaid the pupa-case of the *Hewitsonia* [*Epitola hewitsoni*], which is characteristic in not lying along the bark of the tree with its long axis parallel to the tree surface, but sticks out at about 70° in a very odd position. I will be able to write more fully on the point later.

Feb. 14, 1918.—The big crumpled one that went by the same mail is one of the "*Hewitsonia*" series. When I said there were three species [*Hewitsonia similis, Epitola hewitsoni* and *E. miranda*] I was thinking more of the similarity of larvae, which is quite as close as that between the various *Argiolaus* larvae in shape. Only in the case of *E. hewitsoni* the pupa-case projects outwards at an angle from the substratum on which the pupa rests. The B series of "*Hewitsonia*" [*Epitola miranda*] which is

* In the British Museum this species was assigned to a distinct, undescribed genus.

on the way home also has a projecting pupa, but the third one's [*Hewitsonia similis*] pupa lies along the surface of the substratum. But their larvae and that of *E. honorius* are extremely similar in form, only differing in colour. I am trying to get a carefully differentiated series to clear up the whole thing. I have only seen about 3 species of *Charaxes* larvae. They are all of the same shape and not like any others I know. *Argiolaus* larvae are nearly as alike in some ways, but the *Hewitsonia* or *Epitola* larvae are as unmistakably related by form and habit as *Charaxes* larvae. I thought for a time that the changes in colour were cryptic changes of one form. *Teratoneura* is a little different. *Iridopsis* is nearer, but the larva has the distinctive habit of spinning a silk protection before pupating. You will notice too the likeness of the *Citrinophila* pupa-case to the *Hewitsonia* and *Iridopsis* types. If only I had time and a forest district to work in I could do them all up. When the Director comes back I think I'll try to get a local holiday to a forest district. I know exactly where to look for these things, and I've only to get into a decent district to get lots more of other species. I think I'll have earned a holiday, for I've been nearly 17 months out now without anything but the statutory days—Xmas, Bank, Empire, New Year, and it isn't much. At times I don't feel any too willing to get up early in the morning, and I lose more sleep than I like to. Still one must make the best of things. This is an extra mail, sprung on us on two days' notice, so I won't have time to write more.

C. The Life-history of Iridopsis incredibilis Staud.

[The following notes refer to a male and female *I. incredibilis*, which emerged on Sept. 30 and Nov. 6, 1915, respectively, the pupae having been found on the bark of *Alstonia* a few days earlier. Both pupa-cases were received.]

Nov. 24, 1915.—I also got off two little Lycaenids which I do hope will reach you all right, as I have a feeling that even two (if they arrive in good order) will be, at least in a small way, a Xmas contribution that will interest you. I know the larva, but have not yet got one in spirit. It also comes from the *Hewitsonia*, *Argiolaus maesa*, and *A. alcibiades* tree [*Alstonia congensis*] that Dr. Lamborn

loved here on Moor Plantation. I feel sure they also are relations of *Hewitsonia*. Their larvae are of the same general hairy character and like the others run about in the vicinity of the ant-nest, over the bark of the tree. I am not yet certain what they feed on. I think it must be Algae or dead bark. They have no dorsal glands, and are disregarded by the ants though they run about in their tracks. I think it is an association of mutual respect. The Lycaenid larvae are protected passively, so to speak, by the ants. No other insects that would be likely to harm them will venture near them for fear of the ants. It is not a beneficial partnership (nor yet the reverse), for, as I say, the ants simply ignore them, seeming unable to attack them on the tree.

Feb. 26, 1916.—The *Iridopsis* larva which I once saw was on the *Hewitsonia*-tree here [at Moor Plantation]. I've wondered uneasily several times whether I hadn't misplaced the imago among the Lycaenids, for the brown chitinous-looking pupa-case, distinct and separable from the cast skin which completely envelopes it, is very moth-like. Further the larva spins a fairly dense web of white silk to form a little cage in which I found the pupa in each case. It selects a fairly deep narrow crack or pit in the bark of the tree for the purpose, in a manner recalling the habit of some spiders. I feel sure I'll be able to get more on my return next tour—if the Huns do not get us going or coming by sea. The larva has a denser protection of hairs than the Hewitsonias, but shorter, and they are not quite so active. In shape they rather differ, and as to the process on the pro-legs which I saw in *Hewitsonia* and the *honorius*, I'm not sure in this case.

Agege.

Dec. 15, 1916.—On the way down here [Agege] I stayed two days at Olokemeji, the Forestry headquarters. On an *Albizzia lebbek* Benth., with quite a number of *Iridopsis* empty pupa-cases on it, there was a *Crematogaster* nest similar to the one seen at Agege (p. 354).

[The following paragraph refers to a male *Iridopsis incredibilis* found about Dec. 7, 1916, on the bark of the Leguminous tree mentioned above.]

Moor Plantation.

Feb. 22, 1917.—The name of the tree—"Lebbek"—is a corruption, I think, of an Egyptian name. It is not

native here, but is used as a shade tree. I got a butterfly on it just emerged, which may be an *Iridopsis*.

[The butterfly referred to below is a female *I. incredibilis*, with the pupa-case in its silk-covered depression in the bark. They bear the date of emergence, Jan. 14, and the notes "Larva hairy and predominantly red" and "pupa in shallow depression in bark—silk-covered." There is little doubt that the tree was *Alstonia*.]

Jan. 12, 1918.—I have a Liptenine pupa just now which I found as a pupating larva not long ago—the pupa not unlike a *Teratoneura*, but the larva was different and "went up" in a depression on the bark of the tree after weaving a silk defence like an *Iridopsis*. The silk was finished before I met the larva and I couldn't disturb it, but the predominant colour was red, and I do not think I have seen it before. [*Jan.* 26.—"It is a fine big *Iridopsis*." —C.O.F.]

Feb. 8, 1918.—I send the *Iridopsis* and its pupa-case—it is the one I told you of that had the larva with a lot of red. *Iridopsis* has one curious character: it generally pupates in a niche in the bark of the tree, but first spins a web of silk so as to shut itself in as some spiders do.

Aug. 25, 1918.—[After referring to various Diptera and to larvae of Endomychid beetles, etc., haunting the "ant-tree" (*Alstonia*) at Moor Plantation the letter continues.] There were also one or two young *Hewitsonia* larvae, and I saw an *Iridopsis* come and oviposit. This must sound rather a tall yarn, all these things on one day, but such are the facts.

D. Notes on the Pupation and Life-history of Citrinophila tenera Kirby.

[The single specimen sent by Farquharson is a male. It is accompanied by its pupa-case still attached to the bark of the Pará Rubber tree, *Hevea brasiliensis* Müll. Arg. (Euphorbiaceae). It bears the note "Lycaenid found newly emerged on Pará tree, Agege. Pupa-case found also. 18.x.17."]

Agege.

Oct. 18, 1917.—This forenoon as I was examining tapped surfaces of Pará trees in connection with a really difficult disease problem that I think I may manage to solve, without the aid of a fungus (or, of course, an insect),

I saw a newly emerged Lycaenid, a bright yellow one with black-tipped wings. And just beside it was its empty pupa-case! Nowhere round it was a plant of any sort except rubber, the shade being too dense for weeds, and I feel sure he is of the bark-feeders. I won't send it this mail, for surely such a load would be too much for the old boat. Nor is this an end to the wonders that Lamborn enabled me to see—how I wish he were here! [*Oct.* 20. "The pupa-case is remarkably spiny."—C.O.F.]

Moor Plantation.

Feb. 6, 1918.—There is a shady little place by the river where every day, if I care, I can see a half-dozen of the little yellow and black forms. They are always fluttering round a huge tree with a promising-looking bark, but few ants except *Pheidole*. I feel certain every time I see them that their life-history is about six feet away, but I've had no luck so far. Lycaenids in my limited experience are never far from their breeding-place, but the trouble is to find it. Some of them, of course, may oviposit on the tops of high trees.

II. LYCAENINAE.

A. Notes on the Life-histories of nine Species of Iolaus (Tanuetheira, Argiolaus and Epamera) with Larvae feeding on the Flowers of Loranthus incanus Schum. and Thonn.

[Farquharson's interesting notes are illustrated by the following fine series of bred specimens, with many of the pupa-cases from which they emerged, and some of their larvae sent in spirit. The larvae and many of the pupae, reconstructed from their cases, have been described and figured by Dr. Eltringham in the Appendix (pp. 473–89). The pupa-cases sent by W. A. Lamborn were substituted for Farquharson's in two of the species, and in addition to the West Coast pupae, that of an East African *Argiolaus*, collected by Lamborn and the Rev. K. St. Aubyn Rogers, is described and figured (Pl. XIII, fig. 1; pp. 480–81). Dr. Eltringham also comments on the Guenée gland, the "electric" sensation produced by these larvae, etc. (pp. 484–85). For a brief preliminary statement of the

facts recorded in this section see Proc. Ent. Soc., 1917, p. lxi; 1918, p. lxxix; for Farquharson's observations on ants attendant on larvae of *Myrina*, Proc., 1914, pp. xxiii, xxiv.

1. *Tanuetheira timon* F. (Farquharson's A).—2 ♂ 2 ♀, emerging between Dec. 14, 1917, and Feb. 10, 1918; accompanied by 3 pupa-cases, one noted as that of the first butterfly to emerge, a ♂. The dull green larvae on flowers of *Loranthus incanus* parasitic on sparsely *Pheidole*-haunted *Funtumia elastica* Stapf (Apocynaceae). A larva sent in spirit is figured by Dr. Eltringham together with one of the pupae (Pl. XIII, figs. 5, 7, 11; pp. 478–79).

2. *Argiolaus alcibiades* Kirby (Farquharson's G and "Gall affinis").—5 ♂ 2 ♀, emerging from about August, 1915, to Jan. 24, 1918: 3 ♂ 1 ♀ are accompanied by their precise pupa-cases. Larvae on flowers of *L. incanus*, on *Cremastogaster*-haunted *Alstonia congensis* Engl. (Apocynaceae), never on the same *Loranthus* on *Funtumia*. Most of the specimens bred from pupae found on shrubs beneath the *Alstonia*. One ♀ was bred Oct. 4, 1917, at Moor Plantation, from a larva found at Agege on the flowers of an allied species of *Loranthus*, on the *Cremastogaster*-haunted *Antiaris africana* Engl. (Moraceae). The pupa of a female (Jan. 23, 1918) is figured by Dr. Eltringham (Pl. XIII, fig. 2; p. 480). Lamborn also bred this species from a pupa attached to the leaf of a climber on a tree bearing a huge nest of *Cremastogaster buchneri* (Trans. Ent. Soc., 1913, p. 474).

3. *Argiolaus paneperata* H. H. Druce (Farquharson's B).—7 ♂ 12 ♀, emerging between March 4, 1917, and Feb. 4, 1918: 2 ♂ 4 ♀ accompanied by precise pupa-cases: one ♀ emerged about 8.0 a.m.: one ♀ emerging Jan. 8, 1918, pupated Dec. 29, 1917. In addition to these 19 specimens, a dwarfed ♂, emerging Feb. 9, 1918, and sent as D (*Epamera iasis*), probably belongs to this species. The blue colour resembles that of the ♀ rather than the ♂ *paneperata*, a possible result of unfavourable conditions. It is certainly not *E. iasis*. All the larvae on flowers of *L. incanus* on *Funtumia elastica*, at Moor Plantation, but 2 ♂ emerged at Agege (Oct. 22 and 23, 1917). This, the commonest larva, feeds when the flowers are immature, and exactly resembles their "dull green—a sort of bud-scale green shot with brownish hairs." The larva is figured (Pl. XIII, figs. 9, 18; pp. 479–80).

4. *Argiolaus iulus* Hew. (Farquharson's F).—2 ♂, emerging Feb. 25, 1917, and Jan. 23, 1918. Each is accompanied by its pupa-case (Farquharson's "decorated pupa"). Both larvae were from *L. incanus* on *Alstonia*, although Farquharson specially notes on the label of the 1918 ♂ that he had bred it before from the same *Loranthus* on *Funtumia*. The 1917 pupa is figured (Pl. XIII, fig. 4; p. 480). This species was also bred by Lamborn from larvae on a parasitic climbing plant. He notes that they had a dorsal gland and were attended by a race of *Crematogaster buchneri* (Trans. Ent. Soc., 1913, pp. 474–5).

5. *Argiolaus macsa* Hew. (Farquharson's H and "Gall").—4 ♂ 1 ♀, emerging Aug. 14–24, 1915: all with precise pupa-cases. Larvae on flowers of *L. incanus* on *Alstonia*, never on the same *Loranthus* on *Funtumia*. The larva is also found on an allied *Loranthus* on *Antiaris* at Agege. The figured pupa is an ichneumoned one which has kept its shape better than an empty case. It was collected by Lamborn at Moor Plantation (Pl. XIII, fig. 17; p. 481).

6. *Epamera laon* Hew. (Farquharson's E).—1 ♂: pupation Jan. 16, emergence Jan. 31, 1918. Mole-coloured larva on flowers of *L. incanus* on *Funtumia*. A ♂ pupa collected by Lamborn at Oni, 70 miles E. of Lagos, is figured (Pl. XIII, fig. 15; p. 481). The characteristic position of this pupa, across the stem, was noted on the specimen by Lamborn, Feb. 18, 1912.

7. *Epamera iasis* Hew. (Farquharson's D).—5 ♂ 7 ♀, emerging Jan. 11–Feb. 11, 1918. The ♀ of Jan. 11 is accompanied by its pupa-case, which, although somewhat flattened by the packing, still shows its position across the stem of *Loranthus*, near to a "cushion" (p. 368) which it resembles. All the larvae were on flowers of *L. incanus* on *Funtumia*. This larva replaces the commonest, *A. paneperata*, and becomes itself the most abundant when the flowers mature and open. They are pink or red when young and may become yellow or yellow-orange later on, thus matching the changing colour of the flower.

The last consignment of *E. iasis* included a dwarfed ♂ probably of *A. paneperata* (p. 361) and 2 ♂ of *E. mirabilis* (p. 363).

8. *Epamera farquharsoni* B.-B. (Farquharson's C).—2 ♂ 7 ♀, emerging Jan. 9–14, 1918, the first 6 being ♀. The first ♂ and seventh ♀, of Jan. 13, emerged about 2 p.m. The pupa-cases are of much interest. The ♀ of

Jan. 9 is accompanied by 2 cases to which the same number (C 1) had been accidentally fixed. Each is attached to a stem of *L. incanus* and lies across it in the usual *Epamera* position. A female of Jan. 11 (the ♀ type) and of Jan. 13 are accompanied by their respective cases fixed to the bark of the *Funtumia*. They are extremely well concealed and probably possess the power of individual colour adjustment. The pupa-case of the ♂ (type), Jan. 14, is also fixed to the bark, but close to a prominent ridge which probably supplied the same stimulus as a thin stem; for the pupa lies across it at an angle of 45°. Finally, a pupa-case, found empty on a *Loranthus* stem, lies across it just above a "cushion." This is the specimen figured by Dr. Eltringham (Pl. XIII, fig. 10; p. 482). For the larvae see Pl. XIII, figs. 6, 12; p. 482. As implied above the larvae were always found on flowers of *L. incanus* on *Funtumia*. They are the caterpillars with the extraordinary resemblance to the flowering cushions which surprised and delighted Farquharson.

Farquharson devised an excellent method for sending these pupae in their natural surroundings. A thick piece of bark with the pupa in the centre was cut out, probably with a chisel, and pressed into a thick bed of glue at the bottom of a stout cardboard box. When it arrived, I cut through the glue round the edges of the bark, with a fine-toothed saw, leaving that beneath as a flat base on which the specimen rests in the drawer. The bark and glue were carefully drilled in two places for pins to prevent shifting. Thus all moisture was avoided and the bark with its Cryptogamic growths remains quite unchanged.

For Mr. G. T. Bethune-Baker's description of this species see pp. 462–63.

9. *Epamera mirabilis* H. H. Druce (labelled D by Farquharson).—2 ♂, emerging Feb. 12, 1918, both from the *Funtumia* mistletoe. The specimens were compared with the unique type from Sierra Leone (now in the possession of Mr. J. J. Joicey), and Mr. H. H. Druce agreed that there was no doubt about their specific identity. The ♀ unfortunately still remains unknown; Mr. Druce's conclusion that *mirabilis* is allied to *iasis* is supported by Farquharson's employment of the same letter D for both forms, showing that he did not distinguish them in the earlier stages.

Mr. Druce has informed me that the figure of *mirabilis*

in Trans. Ent. Soc. Lond., 1907, Pl. II, fig. 8, represents only a single hind-wing tail—the central one—although the type possesses all three. In the text (p. 81) and also in the original description (Ann. Mag. N.H. (Ser. 7), vol. xi, 1903, p. 71) there is an inadvertent error in the statement that the insect lacks the row of hairs on the inner margin of the hind-wing under surface. The fore-wing is, of course, intended. The absence of the patch of special scales on the shining area of the hind-wing upper surface where it is overlapped by the fore-wing, and of the hairs on the fore-wing under surface by which, in other species of the genus, these scales are covered, is emphasised by the name *mirabilis*, and leads the author to remark that the species "seems to open up the question very forcibly as to whether distinctive genera can be made on the absence or presence of these 'sexual marks.' It appears to agree in venation exactly with *Epamera*."—E.B.P.]

[In the following extracts from Farquharson's letters the species referred to are indicated in square brackets.]

July 26, 1915.—I got to Lycaenid tree No. 1 [*Alstonia congensis* Engl.] from which the Hewitsonias are obtained, and was looking intently at the bark from different angles. I got nothing on the tree at that time and passed on to the next one. Here Lamborn found that extraordinary gall-like pupa [*Argiolaus maesa* Hew.]. I had the great luck to get a larva which has since pupated. I also found on a small shrub at the base of the tree a pupa of another species [*Argiolaus alcibiades* Kirby]. I can hardly hope that it is one Lamborn didn't get. It was on a leaf. Its shape, with the broad tail attachment, in general resembled the other, but it is not really gall-like. Unfortunately at the head end which appeared to rest on the leaf, there appeared to have been a slight exudation of the living matter. The pupa was a dull olive-green colour. I took it in, however, in hopes that it might not be irretrievably damaged. Yesterday a wretched Ichneumon emerged. But just in case Lamborn didn't get it, I went back yesterday and on another little group of shrubs, hardly more than seedlings, I actually got two healthy-looking pupae, of an apple or Alga green—not shining but dull green like the surface of a tomentose leaf. There had been a third one which had got damaged and was being eaten by little

Cremastogasters off the ant-tree. But the two are safe, and if an Ichneumon comes out I'll be very angry indeed. I went back yesterday evening, and, as the place is rather shady and it was getting dusk, I failed to notice that the ground was simply alive with black drivers before I had quite half a dozen biting like fury under my nether garments and a lot more running up the outside. It was lucky I got the pupae in the morning or they'd have been eaten up that night. There's nothing succeeds like success, and I went there this evening and got another "gall" larva. I was actually expecting to find the larva of the other, and I may do so before long.

July 29, 1915.—The pupa of *A. alcibiades*, though not striking, is in a general way, in its "pose," rather like the gall one [*A. maesa*].

Sept. 28, 1915.—The *alcibiades* larvae do not feed on beans. They come down the ant-tree—Dr. Lamborn's "*Hewitsonia*-tree," a species of *Alstonia* [*congensis*], haunted by *Cremastogaster* ants—just as *maesa* does. They have, I think, a Guenée gland. I've got one in spirit. They have no tubercles.

Feb. 22, 1917.—I think I have two new *Argiolaus* pupae [*A. iulus* of which a ♂, emerging Feb. 25, 1917, was received]. One has just emerged, but it is too soft to kill as yet. I think the *Argiolaus* lives on a *Loranthus* parasitic on the same tree as the Hewitsonias, but I think its food may be a scale on the *Loranthus*. [This paragraph may have been written a few days later than the beginning of the letter.]

Feb. 27, 1917.—Before reaching it [the *Pterocarpus*, p. 382] I had to pass a tree where *Hewitsonia* pupae are at times to be found, and soon found three. For a special reason I examined one or two small shrubs of the undergrowth for other Lycaenid pupae, the special reason being the presence on the large *Hewitsonia*-tree (I do not know the species [*Alstonia congensis*], but believe it to belong to the family Apocynaceae), of two or three large *Loranthus* parasites, which I now believe to be the special habitat of the two species of *Argiolaus* [*A. alcibiades* and *maesa*] which I sent last tour and of the other sent last mail [*A. iulus*]. The larvae (not invariably but frequently) leave the ant-infested *Loranthus* to pupate, often travelling a long distance—60 ft. at least in some cases—to pass the critical, because vulnerable, stage between the larval and

the completed pupal condition. I found two empty pupa-cases of the *Argiolaus* type and passed on to my *Pterocarpus* which was growing near by. Just under it I noticed another empty Lycaenid pupa-case, again of the *Argiolaus* type, which may indeed have come from the *Hewitsonia*-tree.

May 18, 1917.—Did I mention that I believed that the *Argiolaus* were probably somehow connected with a parasitic *Loranthus*? I am now in a position to say that they feed on the *Loranthus* flowers. I will tell you all about it next mail.

Agege.

Oct. 18, 1917.—Just before leaving Ibadan I noticed my *Loranthus* coming into flower. I think it flowers twice a year at least. I thought I'd look for some apparently fully fed larvae, for there's one form I failed to breed. Both the pupae I got were unaccountably spoilt. I found incidentally a large proportion of the flowers galled by a Psyllid, I think. Last time of flowering the flowers were normal. I got two Lycaenid pupae and several larvae [of *A. panepe-rata*]. That was on Friday the 12th inst. As bad luck would have it, I had no excuse left by which to avoid dining out and couldn't get near them on Saturday evening. The day was a busy one and any work on them then impossible. On Sunday I was rather out of sorts (a suspicious circum-stance, but really unconnected with the unfortunate dinner) and in addition had to do some wretched packing up, as also on Monday. All this sounds most neglectful and I grieve to have to admit it, for last night I discovered what I had missed. The larvae had all pupated except one, which was manifestly dead. But in the bottom of the box (a glass-lidded tin of the ordinary kind) were several curious white threads, a ghastly, horrid Nematode I take them to be. There were I think five, two nearly as many inches long. If there is any class of animal on this earth that I loathe, hate and detest it is the Nematode. Snakes are, compared with them, a theme for poets. Perhaps after all it is a case of *ignotum pro horrifico*. Anyhow, they're in a tube with spirit and you'll get them in due course. There was absolutely nothing else in the box from which such huge things could have come unless they lived in the *Loranthus* flowers. Looking at their semi-opaque bodies with a lens, they have almost an annulate appearance and I will not

guarantee their classification. They are unpigmented and *look* like Nematodes. That is enough for me! If I've libelled them it is their own fault. Men have told me that our common large Mantis frequently harbours a very long round worm, but I've never seen one. What I marvel at is their rate of growth, if these worms really did come from the Lycaenid larva. It must have been very rapid.

Port Harcourt.

Nov. 15, 1917.—My friend Dr. Connal, Director of the Medical Research Institute at Yaba near Lagos, examined the Nematodes that I believe to have come from the Lycaenid larva. He thinks they are Filariidae, but all the specimens were females and he would not venture on a nearer diagnosis.

[I submitted the Nematodes to Dr. H. A. Baylis of the Natural History Museum, who could not say more than that they were immature Mermithidae. Dr. Baylis' remarks may induce naturalists to help on the study of this parasitic group :—

"I have looked at the Nematodes from the Lycaenid larva, and am sorry to say that, as I feared, their characters are purely larval, though they are of such a large size. I am afraid, therefore, it is quite impossible for me to attempt to name them. The species to which the Mermithids found in Lepidoptera are most commonly referred (at least in Europe) is *Mermis albicans* v. Sieb., but I suspect that this is a conglomeration of species, which in their larval state it is impossible to separate at present. People should try to keep these worms alive for a time after their emergence from the insects, in order to give them time to mature.... I should be very glad if you would let me have any such living larvae of *Mermis* that you happen to come across. *Feb.* 24, 1920."]

Moor Plantation.

Dec. 24, 1917.—Now for this evening's adventures. I started (perforce) rather late and had very little daylight left, too little for the flies and mosquitoes, but of course I know that if I choose—and I probably shall—I'll get some more to-morrow. But I had noticed a day or so before that my *Loranthus* was exhibiting flower-buds, and I thought it was about time I had seen to it. Now these flowers are, when mature, long, tubular, yellow (a sort of *Potentilla tormentilla* yellow, but with a "matt" surface) things with

red tips, the red being exactly that of a good old-fashioned Bryant and May match. The flower, in fact, has a by no means fanciful resemblance to a "Swan" vesta with a yellow stick. When mature the most abundant Lycaenid on them is one with a pink larva just delicately tinged with yellow and extremely difficult to see unless one knows how to detect them. [It is evident from a later letter, p. 372, that the larva is *E. iasis*; but the commonest species was ultimately found to be *A. paneperata*.] I am to send you a new series of these when they come on, for the *Loranthus* series threatens to be more complex than the *Pterocarpus* one [p. 381]. That tree, too, may soon be coming into flower. This evening's adventure has seriously complicated the *Loranthus* series. The *Loranthus* flowers are verticillate. They arise apparently, season after season, on the same "cushions," to use a term applied to cocoa-flowering. These cushions are rough and warty, brown in colour, tinged here and there with dull green. Arising on them and sticking upwards are found the flowers; at the present stage these are dull green—a sort of bud-scale green shot with brownish hairs. There is no trace of the red tip yet. I was not surprised to find the larva of the form from which I bred the Nematodes [*A. paneperata*]. It is exactly that colour. I expect to get a few and to be able to send one in spirit. I had taken my knife to cut off a "cushion" with its partially developed flowers when my eye caught sight of something that ought to have been a part of the cushion but was—another larva, a perfectly amazing cryptic form with curious knobs and an astonishing and quite indescribable medley of colours, a masterpiece of camouflage! [The larva of *E. farquharsoni*.] I got him safely into my tin and proceeded to cut off the cushion of flowers for it to "chop." Camouflage can have its disadvantages. Alas, I cut another one in two and my joy at finding No. 1 was seriously damped. But before it was too dark I got four in all. I'll get more, I'm sure, and I'll have one to spare for spirit. I'm positive, however, that I didn't overlook these before, when the flowers were in full bloom and the predominant colours were yellow and red. And the pink larva form [*E. iasis*] hasn't arrived yet. The colours [of *E. farquharsoni*] aren't bright nor are they many, but the few there are, green, brown and tiny hints of red, very very slight, are wonderfully blended. The *Argiolaus maesa* has a very odd

larva and is slightly reminiscent of this one, but it is much less "knobby." Altogether to-night I think I have three different *Loranthus* forms and the pink one [*E. iasis*] is not included. All are wonderfully cryptic in their own way. What an astonishing piece of good fortune that a *Loranthus* should have grown on a *Funtumia* branch about ten feet from the ground. I just mount a step-ladder and pick them off in comfort. Curiously enough there are few ants on the trees and one of the forms has glands and tubercles (not *the* one, the camouflage expert). None were actually attended.

Dec. 27, 1917.—An odd thing struck me this evening. I have got, I think, four different larvae on the *Funtumia-Loranthus*. The tree with its parasite is not 30 yards from the *Cremastogaster-Hewitsonia-Argiolaus maesa*-tree, and yet I have never found *A. maesa* on the *Funtumia*, nor the other very large (the largest of all) *Argiolaus alcibiades* that is also found on the ant-tree. Yet I am sure they both feed on the same species of *Loranthus* that is also parasitic on the ant-tree. But it is not a *Funtumia*, though I think it is also Apocynaceous. [It was the Apocynaceous *Alstonia congensis* Engler.] It is much taller, three times as tall, and it may be that the species that oviposit there fly high. Yet it is odd that *maesa* and *alcibiades* are not found on the *Funtumia-Loranthus*, and it suddenly came into my mind this evening that the *Loranthus*-"aura," as it were, may vary according to its host, so that the chemotropic stimulus that impels a butterfly to oviposit in the one case is absent in the other. Of course it may be due to the absence of the Cremastogasters. The *Funtumia-Loranthus* is sparsely ant-tenanted, but a few *Pheidole* sp. being present, it would appear that the Lycaenid species do select particular ants. I have never found the *Funtumia* series pupae anywhere near the *other* tree. The *maesa* larva when it descends for pupation is always accompanied by ants, which it has difficulty in getting rid of in order to pupate in safety.

Dec. 29, 1917.—Two of the new Lycaenids [*E. farquharsoni*] have "gone up." The pupa is as cryptically coloured as the larva. The two pupae are somewhat oddly placed on the twigs of *Loranthus* in lying *across* the twig instead of what is more frequent, along the twig. I am sure this is not accidental. You will see why when I send you material. The pupa in this position resembles a flowering cushion. Undoubtedly the imago, whatever it is, must be first cousin

to Lamborn's delightful "gall" [*A. maesa*]. It is very similar in "poise" and shape. The form with the most markedly "electric" [pp. 376–77] larva (which is a beautiful "Blue" with long tails [*Tanuetheira timon*]) has also pupated. I have put the other in spirit. I bred out an imago before from a pupa. I have lots of pupae of a third and apparently common form [*A. paneperata*]. I think I sent it before along with one which I noted as having an exactly similarly shaped pupa, but more "decorated" [*A. iulus*]. For some reason I haven't got any of the latter just now. The pink forms [*E. iasis*] are beginning to appear now that the flowers are beginning to show more colour though still unopened.

I cannot help thinking that the *Loranthus* series really *are* avoided by ants. I am not saying this simply because I wish to find a meaning for the "electric" sensation [see p. 376]. I noted it before I knew of that. There are *Pheidole* on the tree, but they are in attendance on scales and are partly, I think, attracted by the nectaries of the *Funtumia* flowers. Further, I took a lot of the same *Pheidole* from *Cassia alata*, where they are in attendance on a Jassid, and put them into the *Argiolaus* box, but they took no notice of the larvae. Two of the species *have* tubercles. I cannot find them on the species à camouflage [*E. farquharsoni*]. But I cannot find glands on any of them.

Jan. 8, 1918.—None of the new *Argiolaus* have emerged as yet, but I've a nice group of them and next mail may bring you some good things.

Jan. 12, 1918.—I am glad to say that I am in a position to make *one* emendation, and that is that there are more than *two Argiolaus* on the *Loranthus*. I know of FIVE on the particular *Loranthus* on my most particular *Funtumia*, and in addition it is practically certain that the famous "gall" [*maesa*] and the other which I sent home as "gall affinis" [*alcibiades*]—I haven't the names handy at present, but you sent me them before—almost certainly feed on the same species, though, as I told you in my last letter, the "gall" and the other one elect to live up a very tall tree, much beyond my reach—the *Alstonia* frequented by *Cremastogaster*, *Hewitsonia* and the others. The "gall" and one of my *Funtumia-Loranthus* forms live on the *Hewitsonia-Endomychid-Cremastogaster*-tree at Agege, which bears a very closely related *Loranthus* with purple red-tipped corollas instead of yellow and red-tipped, which by the

way—the host-tree, I mean—is *Antiaris toxicaria*, var. *africana*.* I had just posted my letter on Tuesday when I found on my *Funtumia-Loranthus* still another extraordinary looking larva, very similar to the "camouflage expert" in shape, but in colour nearly black, a sort of dark "mole" colour except for one or two tiny white and brown spots posteriorly. I have searched for others without success and sadly believe that I must have missed them, for the one I had looked like a little bit of dead leaf that had accidentally stuck on a flower. I rather think it is the larva of the "decorated" pupa *Argiolaus* [*A. iulus*] to which I referred in my last letter. [It was the larva of *E. laon*.] I have one of these pupae by me and will soon be able to clear up the point.

Three of my "camouflageurs" [larvae of *E. farquharsoni*] came by an untimely end in a very curious way. A moth (? Pyralid) larva is present in considerable numbers on the flowers. I must have overlooked the presence of one or two of these in one of my tins in which the *Argiolaus* larvae were feeding. They in due course "went up," and I didn't trouble to put in more flowers. The wretched moth larvae attacked three pupae and devoured the contents, to my intense annoyance. If they had eaten the common species I wouldn't have cared so much. Still, I've got four perfect imagines and there are some more to come, for I got three that had pupated on the lichen-covered bark of the *Funtumia*, so wonderfully cryptically coloured, just like little burrs on the tree-stem. I tried to photograph them, but my plates have got heat-fog and I cannot get good definition.

I wonder if I mentioned that I have got another *Loranthus* (same species) on a *Funtumia* close by *the Cremastogaster*-tree and infested with outposts from the main ant-nest. It is in flower like the *Argiolaus* one, but not a single specimen can I find on it. I must draw a plan of the ground showing distances. I introduced Cremastogasters in numbers into a tin containing about a dozen *Argiolaus* larvae, but they made no attempt to attend them. The *Argiolaus-Loranthus* off which I could have got dozens of larvae is but sparsely ant-infested, *Pheidole* sp. being the ant, and they are in attendance only on various *Coccidae* on the *Loranthus*. I can, I think, definitely say that these

* Dr. Stapf informs me that the name *toxicaria* has never been published, and the species is *A. africana* Engl.

larvae are *not* ant-attended in that particular instance at any rate. They have tubercles, seldom extruded, but I really cannot make up my mind about the gland. I have never seen any evidence of secretion, but I have thought I detected the "lips" of a gland. It may be rudimentary. I'll put up a few of the commonest species in spirit for sectioning. In the common, onisciform, ant-attended Lycaenids that I have met, there is no chance of missing the gland. The drop of secretion is always to be seen. The *Argiolaus* larvae also "spit," when handled, a drop of liquid which is at first clear but quickly turns green. It is probably acrid, but I haven't summoned up courage to try.

Jan. 26, 1918.—I have posted for this mail two small boxes, chiefly devoted to the *Loranthus* series of Lycaenids. Six different species are sent, with a larva of four of the species.

The A series [*T. timon*] is not very common. I have only three imagines, one of which only I have sent this mail (so that I may have another try in case the submarines get them). It is a beautiful form as you will see.

B [*A. paneperata*] is perhaps the commonest one, *is*, in fact, till the *Loranthus* flowers are mature and open, when the D [*E. iasis*] series is predominant and common. The B larvae are green—a sort of mistletoe-leaf green. The D series have yellow or red larvae, and may be red when young and later yellow to match the predominant colour of the flower.

The C series [*E. farquharsoni*] is the type with the wonderfully cryptic larva. I cannot describe the colours, but imagine a blend of greens with tiny points of brown or red, such as you can find, say, on a tuft of *Peltigera* or *Cladonia* lichen. I have sent only one pupa-case, not in a typical situation. I'll send you these later, for I'll have to glue them to a small box to be effective.

F [*A. iulus*] came from the *Cremastogaster*-tree (not the *Funtumia-Loranthus*, though the parasite is the same in both cases)—*Alstonia*, the same species as the *Teratoneura*-tree, but a different specimen. But I once bred it before from the *Funtumia-Loranthus*. The larva is very like the B [*paneperata*] type.

The G series is my "gall affinis" [*A. alcibiades*], and is from the *Alstonia-Loranthus*. I haven't sent a "gall" [*A. maesa*], though I had a fine one that got damaged. I have a lot to send yet, but am to distribute them over a few mails.

E, the other wonderful *Loranthus* larva [of *E. laon*]—the dark mole-coloured one—pupated and will, I think, emerge to-morrow. The pupa is extremely like that of C [*E. farquharsoni*].

Feb. 8, 1918.—Lycaenid (*Loranthus*) E [*E. laon*] is the one with the mole-coloured larva. The pupa is extremely like that of the C [*E. farquharsoni*] series—the ones with the "rugose" larva with the lichenoid colouring.

Feb. 14, 1918.—I hope my last little collection gets home, especially as one of the *Argiolaus*, type E [F had been written, evidently in error], is a unique one. I haven't a duplicate, and I hope the pupa-cases sent of the C group [*E. farquharsoni*] will reach you all right. They are on natural substrata, as found in the open.

I think I must have accidentally mis-described the Nematode-infested larva, which is one of the B [*A. paneperata*] series of *Loranthus* Lycaenids [see p. 366].

March 2, 1918.—In the box I send you is a tube with the Filariid worms from the B *Loranthus* Lycaenid larva. I also send you duplicate larvae of the B and C series. There are signs of more flowers soon, and I may get some more. The first of the series are home anyhow. I hope the second lot will get there, for it contains the unique E specimen. You will see that I send you still another of the rarer A type [*T. timon*] which is the most beautiful of all, I think.

March 23, 1918.—I think the whole of the *Loranthus* series have got home, and I am waiting as patiently as possible to hear what they are.

April 17, 1918.—I am looking forward to the identification of the *Loranthus* series. It was luck to get them all home, especially as one of them was a unique specimen. I'll prepare herbarium specimens of the host-plant when it flowers again. It is not a pubescent species, but has thick, "cold," almost succulent leaves, which are quite glabrous. So also are the flowers.

April 28, 1918.—I duly received your long letter with all the details about the *Loranthus* Lycaenids. The host-plant is just coming into flower, and I will make a point of getting material for Kew. In spite of a certain dissimilarity of the larvae, there is an unmistakable broad similarity, and I suppose the genera are nearly related.

May 28, 1918.—I am busy getting ready to hand over to the Director of Agriculture, who is now on his way out, and have only time for a short note about a parcel I send you by this mail. There is nothing of any consequence in

it. I have sent an extra lot of the B series [*A. paneperata*] of the *Loranthus* Lycaenids, of which so many came out that I got the numbers mixed so I have not the cases. My stock of tins was too limited to give them all extra boxes. However, I send them really to see how the sex proportion will turn out. The B species is, I think, the commonest of all, then the D [*Epamera iasis*]. The "gall," *A. maesa*, and *alcibiades* are not uncommon either. They *are*, of course, if one doesn't know where to find their larvae, practically all *uncommon*.

The larvae are all quite distinct, and yet there is a general similarity of shape and in "poise," also of the pupae. The pupae of C [*E. farquharsoni*] and of the unique specimen E [*E. laon*] are really very similar, as are their larvae, although widely different in colour. Their shape is not so very different from the "gall" larva, but is very different from either A—*Tanuetheira timon* (a nice name and appropriate), or B—*Argiolaus paneperata*. A and B larvae are very similar, but differ a little anteriorly in A larvae having an extra pair of little prominences. Both are of the same dull green colour.

D [*E. iasis*] rather differs, though its shape (larval) is to my mind strongly reminiscent of B. Its colour varies from yellow-orange to red (the red of a Bryant and May non-safety match). Its pupa, though differing in colour, yet to me recalls B, especially, and B's pupa again is just like a small *alcibiades*. The larvae of *alcibiades* are like very large B larvae. As I have said above, to my thinking the larvae of C, E and *maesa* form a natural group. I can assure you that I could not mistake the larva of any one of them for that of any other. The pupae are also distinct. The only two that I might confuse as pupae would be C and E. The "decorated" pupa F is extremely reminiscent of B, and, by the way, its larva, which I didn't get this time but got once before, is to my recollection very like that of B and at the moment I cannot recall how to distinguish them. The affinities of the series to me then may be represented thus :—

Group I { A [*T. timon*], B [*A. paneperata*], F [*A. iulus*], G [*A. alcibiades*], D [*E. iasis*] } especially A, B and F.

Group II { C [*E. farquharsoni*] / E [*E. laon*] / *A. maesa*.

[The above-mentioned eight species are all included in *Iolaus* by Aurivillius (Rhop. Aethiop., p. 546), whose order is followed on pp. 361–63, although the genera of other systematists are accepted. To become consistent with these, *Argiolaus maesa* should change places with *Epamera iasis* in Farquharson's groups, thus bringing together all the species of each genus. Farquharson considered that the pupa of *iasis* resembled that of *paneperata*, but the single example sent is clearly the short pupa of an *Epamera* with the characteristic position. The pupa of *A. maesa* is greatly modified, and its affinity obscured by its extraordinary resemblance to a gall. The bud-like pupa of *T. timon* is of a very different shape from that of *Argiolaus*. Farquharson's material and observations taken as a whole appear to me to support the validity of the three genera *Tanuetheira*, *Argiolaus* and *Epamera*.]

Aug. 11, 1918.—I think you will have got my letter in which I attempted to relate the members of the *Loranthus* complex according to larval characters. I think *Epamera* was my expectation. Before I leave these, I think I said before that these larvae are *not* ant-attended. The particular *Loranthus* is a parasite on a *Funtumia elastica* about fifty yards from the *Cremastogaster-Alstonia*, from whose numerous *Loranthus* parasites the "gall" comes very commonly. But on the *Funtumia-Loranthus* there are practically no ants at all, except a few *Pheidole*, which absolutely ignore the larvae. I am certain that I never found one larva attended by ants on that tree. Now, oddly enough, not twenty feet from the *Alstonia* is another *Funtumia* (same species) with a gorgeous specimen of the same *Loranthus* on it. It is simply infested with *Cremastogaster*. It is from it that I took the specimens for Kew, and though I have searched again and again at the same time as I was getting larvae from the other *Loranthus*, I never found a single larva on it. Yet *alcibiades* and *maesa* regularly come down the *Cremastogaster*-infested trunk of the *Alstonia* to get away from the tree for pupation, but they are, I think, left alone, till pupation at least. Not infrequently I have seen cases where the larva had pupated on a weed too near the tree, and the ants had discovered the pupa and destroyed it.

Aug. 12, 1918.—I have posted two parcels, one containing a flowering specimen—in spirit—of the *Argiolaus-Loranthus* [*L. incanus* Schum. and Thonn.]. I shall get fruits later.

10. *An "Electric" Sensation caused by handling the Larvae of Argiolaus and allied Genera.*

Dec. 27, 1917.—Xmas here was a very quiet time. I spent all of it, except the evening, in the open and was on the whole rewarded. I made a curious discovery in handling two (species, I think) of the *Loranthus* larvae. These larvae are of very characteristic shape, which is difficult to describe. They are rather Molluscoid or Limacoid than onisciform, though they are smooth except at the margin, which is minutely bristly, doubtless to protect the feet. The "carapace" besides comes right down so that the feet are not visible. In section the larvae are more or less triangular. The posterior part is bilobed, and in one of the species there are little lobes anteriorly. They have tubercles, exserted very rarely, but if they have a gland it is hard to see. I recall my note above [pp. 369, 370] on the absence of attendant ants in view of what I am about to tell you, which I had not observed before. These larvae are relatively large so that it is possible to lift them between the finger and thumb towards the anterior end, and without the skin of the fingers coming in contact with the marginal overfold. In handling one of these, I suddenly was conscious of a curious sensation in my finger and thumb which is very difficult of description. As near as possible it reminded me of a very faint electric shock, not accompanied by a prickly sensation but rather as if one were being tickled by a tiny brush of slightly strong bristles. Now the skin of the finger and thumb, or the parts used in handling a small object is fairly hard and not over-sensitive. I doubt if mere surface mechanical irritation by minute bristles, which I cannot detect even with a $\times 10$ Zeiss pocket lens, could have produced the effect. The sensation was not that of tickling so much as that of a faint shock, which was not continuous but rapidly intermittent. The skin of the larva is covered with yellow dots, very minute and scarcely visible to the unaided eye, like glandular dots on a leaf. To make sure that the whole thing was not illusion I got my boy to hold one and to say if he felt anything. He replied in good "pidgin"—"he scratch my hand," by which I think he meant tickles. At any

rate, so far as I can make out, there is nothing on the larval epidermis to scratch anybody's hand. On putting the larva down there was no after-sensation which hardly indicates stinging. I had another larva very similar in appearance but a different species—if anything smoother. I thought at first that it had not the same property. I tried it on the boy and he felt it. I tried it again myself, but though it was rather less pronounced than the other, there was no question about it responding in the same way. I will put up spirit material and perhaps Dr. Eltringham will investigate the nature of the gland-cells, for I'm sure the minute yellowish dots are the seat of the response, whatever its nature. I myself believe it to be electrical. I find it hard to say why, except that it reminds me of nothing else so much as the queer "internal" tickling that a faint discharge produces. "Internal" is the only adjective I can think of, meaning thereby that the sensation is felt up the inside of the finger, as it were, rather than on the surface, like tickling, in fact. I do not know the vocabulary of experimental psychology, but perhaps you see what I am trying to get at. The cryptically coloured, knobby larva [of *E. farquharsoni*] does not possess the property. I have got, I think, ten of these now, but none so far have pupated.

Dec. 29, 1917.—The larva [of *E. farquharsoni*] *is* slightly "electric" also, perceptibly so in well-grown larvae. *Tanuetheira timon* is the form with the most markedly "electric" larva.

March 23, 1918.—I thought of an electroscope, but I fear that is beyond my reach, though I may manage to borrow one at the High School in Lagos.

[Dr. Eltringham is inclined to think that the "electric" sensation may be caused by a shivering motion of the larva, causing the rough cuticle to vibrate against the skin: pp. 484–85.]

B. Notes on the Life-history of two Species of Deudorix and one of Catochrysops which bore in the Pods of Canavalia ensiformis D. C. (Leguminosae).

[The following material illustrates the notes:—

1. *Deudorix antalus* Hopff.—2 ♂ 5 ♀, emerging Feb. 19–23, 1918, and 1 ♀ March 1. Each of the former 7 is

accompanied by its precise pupa-case. Also from larvae collected on *Canavalia* at Agege—3 ♂ 1 ♀, emerging March 2–7.

2. *Deudorix odana* H. H. Druce.—1 ♂ 2 ♀, emerging Feb. 21–22, 1918; each with its precise pupa-case, that of the ♀ of Feb. 22 remaining in a tightly rolled leaf or pod, bearing Farquharson's note—"butterfly somehow managed to emerge." In spite of the very small opening it is a fine specimen. The larva must closely resemble that of *antalus*, for this keen and most observant naturalist thought he was dealing with a single species of large larva and accordingly labelled both with a single series of letters following the order of emergence. He would of course have detected the difference between the butterflies, but there is no doubt that these were packed off at once without examination. Farquharson's is the first record of the early stages of the species. Although the male of *odana* appears to be common—Lamborn took a fine series at Oni—the female has rarely been seen; indeed, I only know of two other examples, both in the collection of Mr. Bethune-Baker, who has now kindly drawn up a short description of this sex and added a note on the variation of the species (p. 463).

3. *Catochrysops malathana* Boisd.—1 ♂, emerging Feb. 19, 1918; accompanied by its pupa-case. Also bred by W. A. Lamborn from a Leguminous pod and sent accompanied by attendant ants (Trans. Ent. Soc., 1913, p. 488).]

Feb. 4, 1918.—The Harmattan is very strong just now and insect life is hardly at its maximum activity. In fact things are hard to get. I drew a complete blank yesterday—my Sunday—much to my disgust. However, this evening things brightened a little. I got a *Pterocarpus* larva [p. 385]. I think they are about to appear, and I took it into my head to look for a *Catochrysops* on a bean we grow here, *Canavalia gladiata*—or *ensiformis* I believe it is—: I'll look it up, in view of the possibility of a revision of the genus. Lamborn, I remember, bred one out of the pods of the Pigeon Pea, *Cajanus indicus*, here, which he told me was *C. malathana*. I remember it went to the B.M., being an official matter, and if my memory serves me aright, he learnt to his surprise that it was something else, something or other *boetica*, I think, but the B.M. will be able to tell you. I pass *Canavalia* plots every day and I have looked casually at them too without result, but other things were

trumps just then, such as *Argiolaus*. But I was driven to concentrate on it to-night. Virtue had its own reward! I have got two species of Lycaenids, one I think a *Catochrysops*, the other looks rather more like my *Pterocarpus* friends, but I'm not really sure. I don't know it anyhow, and it's a fairly useful-looking larva—not a tiny form. I've got six and I'll get more now I know where to find them. Mr. Massee, who saw more in the field than ten average men, used to quote to me a saying of M. C. Cooke's which was something like this: "If you can't find a thing (that you have reason to think ought to be there) sit down till you do find it." It isn't bad advice, if one really has the luck to have good eyesight and something of a field instinct. I've got the eyesight all right, but as for the field instinct—well I must touch wood. The more I find the more I marvel how I missed the things so long. The little bush we have left here and the Harmattan together have reduced me to a "field" of 4 or 5 ant-trees.

Feb. 5, 1918.—*Canavalia* is of the family Leguminosae. The species on which I find the Lycaenids is, I think, native, but it is one widely cultivated in the Old and New World tropics, and ours are actually grown from introduced seed. Yet a wild form (if it isn't a distinct species) is common round here.

There are without doubt two Lycaenids concerned, both boring into the pod—one a typically onisciform one which I think will prove to be "*malathana*;" but the other is very different—a plump, rather large larva that at first sight suggests a slightly pigmented Coleopterous larva or an Aegeriid. I was at a loss to recall what they did resemble more than Coleopterous larvae. Then I recalled the Aegeriids and had a spasm of doubt; but there *is* a gland, though it doesn't seem to function often, but the larvae are attended inside the borings by a tiny ant like a rather dark-coloured *Monomorium*. But the larva bores right inside the large bean: it is bigger or at least fatter than a broad bean, and the presence of larvae is indicated either by fresh frass round the opening or by a busy little crowd of ants running in and out. The little ant is always on the plants, larvae or no larvae, the inflorescence being very glandular. In addition a Jassid is present in small numbers. The larva is really quite Aegeriid-like, of a straw-colour generally, but with the anterior segment bright red, and rows of brownish purple spots along the sides. It is,

however, slightly bristly, recalling one at least of the *Pterocarpus* forms, only much larger. It must be quite a large species, or it is a horrid deception. We have the bean planted all over the place as a cover crop, but I have so far found the larvae only in the heavily shaded river-side plots. But in these there are abundant traces of their activities in the shape of holes, although I haven't met with a single pupa. The plots are clear of weeds, so that if they leave the host-plant for pupation they must travel a good way. Some of my larvae I am sure are replete and will pupate in a day or two.

Feb. 6, 1918.—The new larvae didn't pupate; I think it was a moult-rest, for they were all active this morning. I cannot see a trace of tubercles, but I am sure there is a Guenée opening, though the gland doesn't seem to function. Somehow I shall be glad when one goes up, for the larvae are rather odd in more respects than one. When feeding they are short and fat, but on the move they are quite long, longer than any Lycaenid larva I have yet met, and extremely Aegeriid-like except for the concealed head, which, however, is thrust out when they are full-stretched and walking. But a short and rather stout pro-leg process (p. 352) is present which is rather reassuring. The spots are rather variable in colour—purple-brown, I think, only in the younger larvae. More mature larvae have the spots a very unusual indigo-blue colour. The rather striking pigmentation, blue spots on a straw-coloured "ground" with a red head, is odd in a boring larva.

A few Sundays ago [Dec. 8, 1917: see p. 325] I saw a very recently emerged (but flying) and perfectly gorgeous, tailed "Copper" on the edge of a *Canavalia* plot where I have got several larvae. I am wondering if it may not be the one I'm on the track of, but I'll just have to possess my soul in patience. But I did tell that "Copper," with no little fervour, how much I'd like to see her oviposit on something. She didn't oblige, however.

Leguminosae seem to be favourite food-plants of the [Lycaenid] "herbivora" and "anthophaga." As a matter of fact, I *had* looked at the flowers of *Canavalia* two or three weeks ago, but drew a blank and only came to look at the fruits in case of a *Catochrysops* having taken an interest in the plant.

March 2, 1918.—By this mail I am sending you a small box with the *Canavalia ensiformis* Lycaenids. Only one

of the small forms has come out so far. I have a few to come, reared from the same plant at Agege, just to find out if there is any difference. They are fine large forms, rather resembling the famous "*Camponotus maculatus*" form [*Catochrysops phasma*, p. 392]. I have sent you the pupa-cases also. They have a most distinct silk girdle placed about the middle of the body. I was disappointed to find that it was not the gorgeous "Copper," but I may get these one day.

C. Notes on three Lycaeninae, their Parasites, and two Moths, feeding on the Ant-infested Flowers of Pterocarpus esculenta Schum. and Thonn. (Leguminosae).

[The following material illustrates Farquharson's notes:—

I. Lepidoptera.

1. *Deudorix* (*Pilodeudorix*) *diyllus* Hew.—10 ♂ 9 ♀, emerging March 11–20, 1917, each of the first 10 with its precise pupa-case. Emergence takes place about 8.0 or 9.0 a.m., as may be inferred from the following data on the labels: 8.0 — ♀; about 8.0 — ♂; after 8.0 — ♀♀; after 8.30 — ♂ ♀; 9.0 — ♂. An example of the larva, which is distinguished from that of *camerona* by its more tuberculate appearance, is figured by Dr. Eltringham on Pl. XIII, fig. 14, p. 484; and a ♂ pupa on Pl. XIII, fig. 8, p. 484. The pupa resembles on a small scale those of *Deudorix antalus* and *odana*. The female imagines of this species and *camerona* are briefly described by Mr. Bethune-Baker on p. 464.

2. *Deudorix* (*Pilodeudorix*) *camerona* Plötz.—2 ♂ 2 ♀, emerging March 15–18, 1917, a ♀ of March 15, "after 8.30 a.m." A ♂, March 16, bears the note "? Less tuberculate larva," and a ♀, March 18—"Smooth larva."

3. *Lycaenesthes musagetes* Holl.—1 ♀, emerging March 18, 1917. It bears the note "From green onisciform larva." The early stages of this species, as of *diyllus* and *camerona*, were unknown.

For a preliminary announcement of the breeding of these three Lycaenidae see Proc. Ent. Soc., 1917, p. lxi.

4. *Maruca testulalis* Hübn.: *Pyralidae*, *Pyraustinae*.—1, emerging March 13, 1917. A moth of world-wide distribution.

5. *Olethreutes* sp. nr. *wahlbergiana* Z.: *Tortricidae*.—1, emerging March 11, 1917.

II. Diptera.

6. *Exorista poultoni* Villen., sp. n.: *Tachinidae*.—1 ♂, bearing the note "Ex *Pterocarpus* Lycaenid." The date was some time in March, 1917. This brilliant black species has been kindly described by Dr. Villeneuve on p. 518. This fly and the following Ichneumonid were parasitic on one of the species of *Deudorix*, probably *diyllus*.

III. Hymenoptera.

7. *Adelotropis farquharsoni* Waterston, gen. et sp. n.: *Ichneumonidae, Joppinae*. — Bearing the note "From *Pterocarpus* Lycaenid. 22.iii.1917." Described by Dr. J. Waterston on pp. 455–58.—E.B.P.]

Feb. 27, 1917.—I was in luck's way on Sunday. . . . Just lately the orange-yellow blossoms of a small tree that grows along the river-bank, at times with its roots entirely in the water, have been very conspicuous. The tree I was told was a species of *Pterocarpus*. To verify this and to get a nearer view I went down to one of the more accessible specimens. [The presence of an empty pupa of *Argiolaus* type just below the tree, as alluded to on p. 366,] led me to look rather closely at the *Pterocarpus*, the first non-botanical feature observed being the presence of *Oecophylla* nests, and workers running about the leaves and inflorescences. I pulled down a flower-bearing branch very gently, it was the only one within reach and had to be carefully handled. *Oecophylla* is a jealous animal, *ὑβριστικόν τι*. Then I saw what I took to be a Limacod larva, not so brightly coloured as these usually are nor the characteristic green or yellow, but spiny and tuberculate and of a russet colour not unlike that of a withered *Pterocarpus* flower. Two ants were running about the inflorescence, but up to this point I didn't associate them with the larva. I was in two minds whether I could spare the time to breed out a Limacod (the larva was, for one of these, rather small and doubtless young), and for some obscure reason decided to take it in. I shook the ants off the flower and did so. Force of habit made me examine its wonderful armament with a lens, and I thought I detected a pronounced non-Limacod character. I soon satisfied myself that it had tubercles and a Guenée gland. Very soon I had in the tin a more discerning *Oecophylla*, which made

straight for the gland and tickled it in a way that an *Oecophylla* doesn't usually tickle other animals. I couldn't reach another inflorescence, so hastened home for a more leisurely study. What I believe to have been a Psyllid jumped off the flower, but I thought there would perhaps be others concealed among the flowers, which are rather crowded. In this, as it turned out, I was disappointed. I got out Lamborn on the "Relationships," [Trans. Ent. Soc., 1913, p. 436], and decided that I'd got hold of a larva not unlike that of *Megalopalpus zymna*, with a new attendant ant perhaps. I noticed that the pro-legs had the curious little protrusible "sucker" that I have seen in *Hewitsonia* larvae and in others of the "hairy" group, though this one is not of that type at all, being sluggish in its movements and of onisciform habit (but for the tubercles and spines, with the overlapping "carapace" concealing the legs), and while intently watching these details through the glass cover of the little box in which I'd put it, noticed for the first time that it was not a "carnivore," but was contentedly devouring the corolla of one of the flowers forming the inflorescence, just like any ordinary, common, garden caterpillar. I had a further search through the "Relationships" to see if any spiny form described by Lamborn had such comparatively refined tastes, but found, unless I have overlooked some detail, that his were very gross feeders and that some had in fact been guilty of the "basest ingratitude," for reasons well set forth therein. But I cannot persuade myself that he didn't find this one, if not at Oni, perhaps here. I have since managed to get one or two more, but none have so far pupated. But I am fairly hopeful unless something goes wrong.

Feb. 28, 1917.—I rather think one or two of my *Pterocarpus* Lycaenids are about to "go up." If not they are about to "go West."

I have had a further study of the larvae. Their colour is not the simple russet that I supposed, for on closer examination with a lens and by the microscope (reflected light) I find that there are little areas of a sort of olive-green colour and others of such light brown as almost to be yellow. The very young larva is, however, pale straw-coloured. The larva is very sluggish, and I got a good view of the tubercles in action with the aid of the microscope. The tubercle of this species, at any rate, is not an organ

thrust out through an orifice. It is rather a diverticulum of the epidermis (though other layers may be involved) which is invaginated and exserted alternately. It is crowned by minute "tentacles," which so far as I can make out are not distinct hairs but are produced by a lobing of the upper part of the tubercle. I could not actually detect any orifice, these tentacles being so numerous. Very likely their structure has all been written up, but it may interest you to get this impression of a study of the living larva. I am a poor artist, but I'll try to express my meaning in a rough sketch. The invagination appeared to me to be aptly comparable to the effect produced by one in turning a stocking inside out (the initial stage) or a glove finger.

I am afraid my sketches are hopeless, but when the tubercle is completely retracted the position of the tubercle shows a slight pit with a "pursed" centre. Looking down on the point by reflected light it had a curious resemblance to a starch grain under high magnification, rather like this [sketch]. The extrusion of the tubercles was rather spasmodic. I could not, of course, study it with an *Oecophylla* in situ, for freedom was more attractive to the ant than the Guenée gland. Sometimes the tubercles would continue invaginating and being extruded rapidly for a short space of time and then stop, to be resumed after a bit. I hope to study the movements more in the next few days.

March 1, 1917.—One of my *Pterocarpus* Lycaenid larvae pupated to-day. Another was on the way, and I was wondering why it didn't, when I noticed an "injury" just behind the head on the dorsal surface. I soon discovered the cause, for a wretched Tachinid puparium was lying in the tin and I very nearly overlooked it. It has struck me that this particular Tachinid has made an unlucky or at least risky selection of a host; for the tree always overhangs the river completely, and if the emerging larva is unable to freeze on to anything it would stand a mighty chance of a watery grave. The Lycaenid itself might have done better, for the inflorescences appear to provide food for two or three moths, a beetle, Psyllids and possibly other things, and can't possibly mature many fruits. So hopelessly damaged are some of the flower-heads that what is left is almost sure to drop off into the water. I haven't seen the Lycaenid pupae in

the open yet, and the one I have is simply lying loose in the box. It didn't manage to stick on to anything. It possibly hangs or sticks on to the withering inflorescence of which the calyces at least are persistent, which may explain the minutely spinose pupa-case, though this character may quite as well be protective, for the inflorescence is not very tomentose, at least what remains of it when the withered corolla falls off. . . . I am curious to see the next pupa. The one I have now is mottled with small dark green (?) spots, with a brownish ground, and would be very inconspicuous among half-withered vegetation.

March 9, 1917.—I will be able next mail to send the *Pterocarpus* Lycaenid (or two perhaps, for I'm not sure, but I'm dealing with two very similar-looking larvae) along with the others. The first of these ought to come out to-morrow or Sunday. Two are tachinised. Now I must stop this unwieldy letter. I hope I have escaped the Scylla of mal-observation and the horrid Charybdis of bad philosophy. At any rate, I'll make certain that I have a very good box of material for next mail. I think I'll send it in two lots in case one lot gets torpedoed. The *Pterocarpus* flowering is just getting finished, and I won't get more material there for a time.

The *Pterocarpus* pupa has a girdle fixing it to the surface it pupates on. In the case of the first pupa I must have accidentally broken this in clearing away the remains of the food-plant and excreta.

March 11, 1917.—Two of my *Pterocarpus* Lycaenids emerged to-day. For the size of the larva, which is relatively large, the imago is very small, with small tails on the hind-wings. The first one emerged about 9 a.m., just before I started on my usual hunt. It was not out at 8.30 when I finished breakfast. In the interval I was getting tins ready for the foray. I did not see the second Lycaenid emerge, for I did not get back till a little after noon, very thirsty, very hot, but fairly well satisfied.

March 18, 1917.—I have now got about 20 imagines of the *Pterocarpus* Lycaenid or Lycaenids, for I think there are at least two and possibly three, unless the larva is a variable thing. I will write details with the specimens.

March 2, 1918.—For some obscure reason I have so far drawn blank in *Pterocarpus*, finding only three larvae, all of which I lost, one parasitised, the others by mould, I think. [One larva, taken Feb. 4, 1918, is mentioned on p. 378.]

D. Notes on the Larva of Lycaenesthes lunulata Trim., feeding on Berlinia sp. (Leguminosae).

[The material consists of 6 ♂ and 2 ♀ imagines, all of which emerged Jan. 8, 1918.]

Dec. 29, 1917.—I got a solitary *Pterocarpus* larva to-day; the trees are just beginning to flower. I also made a gathering from a plant that I cannot as yet identify. The young leaves when first they open are a light reddish-purple colour—a very common form of young foliage in this part of the world. As they get older the leaves get tinged with green and finally green. I have a series of larvae coloured appropriately to the different stages, some being pale reddish purple, some the same but tinged with green, and some are bright green. I rather think they are all one thing, for the shape is rather characteristic, an unusually large onisciform type and rather flat, with gland and tubercles and attended by a *Pheidole*—vigorously attended.

Jan. 12, 1918.—There is no doubt these larvae adapt their colour to the food-plant, some being green, some red. So also does one of the *Loranthus* larvae [*Epamera iasis*, p. 372; also a Labiate-feeding Lycaenid larva—pp. 100–101].

Jan. 26, 1918.—The *Berlinia* series all emerged on the same day. I couldn't separate the cases as they "went up" before I could separate them in the tin, but I'll get more.

Feb. 5, 1918.—In case I forget to mention it, *Berlinia* belongs to the Leguminosae, the species on which I found the Lycaenid being a large rain-forest tree *typically*, but here growing by the river-side.

Aug. 11, 1918.—I have been looking for more larvae on *Berlinia*, but the trees have no young foliage at present. The larvae do not eat the old hard leaves. There will be no difficulty, however, about getting them later on.

[The trees were still the same on Aug. 25, when the statement was repeated that "the larvae certainly vary from red to green."]

E. The Larva of Lycaenesthes crawshayi Butl., feeding on Cassia alata L. (Leguminosae).

[Material:—1 ♂ 3 ♀ of *L. crawshayi*, emerging March 21–22, 1917: also a dwarfed ♀, probably of this species, with its pupa-case, from a larva found on the stem of *Antiaris africana*, at Agege.]

March 18, 1917.—I have also some other Lycaenid larvae at present, off *Cassia alata*. I think Lamborn had these too when he was here. They are, I think, vegetarians, though the plant is covered with Jassids.

Agege.

Sept. 27, 1917.—I forgot to mention that I found a tiny Lycaenid larva on a *Cremastogaster-Hewitsonia-Argiolaus*-tree here, which pupated—the tiniest butterfly pupa I've ever seen. I hope it will emerge all right. I must tell you of it later, as the boy must now run to catch a little local train from Agege to Lagos.

Moor Plantation.

April 17, 1918.—I am a little surprised to hear that the tiny *Antiaris* Lycaenid may be the same as the *Berlinia* one; the pupa-case *and* the larva were really rather different. [Relying upon memory I had, by a slip, written *Berlinia* instead of *Cassia alata*.]

F. The Larva of Triclema lamias Hew., feeding on the Coccid Lecanium (Saissetia), on Imbricaria maxima Poir. (Sapotaceae).

[The material received is as follows:—

1. *Triclema lamias* Hew.—1 ♂, emerging Dec. 25, 1917; pupation Dec. 15–17. The specimen is accompanied by its pupa-case, also by the case of an example (pupation Dec. 15–17; emergence Dec. 24) not itself received.

2. *Lecanium* (*Saissetia*) *farquharsoni* Newst., sp. n. (p. 530).—♀ adults, old and young, together with nymphs. The attendant ants were not received.]

Dec. 13, 1917.—"I've just come back from my evening stroll. I went down to our old haunt (Lamborn's and mine) to look into the welfare of two Lycaenid larvae that have, for the last few days, been slowly devouring a happy family of Coccidae (? *Lecanium*) on a young plant of *Imbricaria maxima*. Of them more anon." [Quoted from Proc. Ent. Soc., 1918, p. xxx.]

Dec. 24, 1917.—The two Coccid-eating larvae that I found on *Imbricaria maxima* pupated in my absence in Agege last week-end. The first emerged to-day. I have an idea that it is very near Lamborn's *L. lachares*.* The

* The under surface pattern is, as Farquharson wrote, very like that of *L. lachares*. The genera *Triclema* and *Lycaenesthes* are closely allied. Aurivillius groups all the species under the latter genus.—E.B.P.

upper surface of the wings is black, the under of a pattern very like that of *lachares*. I have spirit material of the Coccids and have attendant ants. The other imago will emerge to-morrow. The larva was green (dull), onisciform, with just a hint of a white line along the edge of the mantle and a slightly lighter mid-dorsal line. There was a gland, but I could not see any sign of tubercles.

Aug. 11, 1918.—Before I forget I must clear up the point about the *Imbricaria*-Coccid-eater. The larvae were not fully fed when I collected them. Fearing that I might lose them, I cut off a twig with the Coccids on it, and completed the life-history in my house. [This was in answer to a letter in which I pointed out the extreme interest of the observation and the importance of confirming it. Lamborn had shown that the larvae of the allied *T. lucretilis* Hew. is associated with Coccid-tending ants, but did not think that they were carnivorous (Trans. Ent. Soc., 1913, p. 486). Farquharson's notes suggested further observation of this latter species. Lamborn had seen the larvae eating the dark green cortex of a soft plant, but at some later stage they may have attacked the ant-tended Coccids he found in tunnels in the same stems.]

G. The Larva of Lachnocnema bibulus F., feeding on Secretion of immature Ant-attended Membracids and on Living Membracids and Jassids: its Pupa attended by Camponotus.

[1. The material of the 1915 note:—

Lachnocnema bibulus F.—1 ♀ (var. with quadrate pale spot outside end of F.W. cell), emerging June 4, 1915; with pupa-case, and a ♀ of *Camponotus maculatus* F., sub-sp. *melanocnemis* Santschi, bearing note "Actual ant found in association with Lycaenid pupa." Many additional workers were sent: see p. 423.]

July 3, 1915.—No. 5 is a Lycaenid about which I am very curious to hear. I found the pupa near an exit of the large *Camponotus* var. [nest: see p. 423], with the ant 5*b* apparently stroking it with its antennae. This may have been accidental. You will be able to judge when you see the Lycaenid (if it reaches you safely), for it may be one described, as regards its relationships, by Lamborn. Till I hear from you on this point I will make no further comment. 5*a* is its pupa-case.

[2. The material of the 1917 and 1918 notes:—

Lachnocnema bibulus.—2 ♂ 3 ♀. One ♂ and one ♀ pupated March 13, 1917, and emerged March 22; a second female emerged on the same day, all 3 with precise pupa-cases; a third female emerged at Ogo, March 25. The first-mentioned female bears the note "Larva on secretion of ant-attended immature Membracids on small Leguminous shrub," the other specimens a shortened form of the same. The second ♂ emerged Jan. 4, 1918. It is accompanied by its case and the note "Jassid-eater. New series, formerly found eating Membracids (1917)."

The attacks of this larva upon ant-tended *Jassidae* are described by Lamborn (Trans. Ent. Soc., 1913, pp. 470–1), and he thought, but was not sure, that the ants fed it. Farquharson's notes add greatly to our knowledge of the larval habits and food. For a brief preliminary statement see Proc. Ent. Soc., 1917, p. lxi.]

March 11, 1917.—I have seen another Lycaenid, probably one of those found by Lamborn, but perhaps my observations may complement or corroborate his. This one is part of a Membracid association along with a small black ant that habitually lives in the débris that collects in Oil Palm heads but forages down below. I once had two fine nests of them last year, many of the callows having mite "balancer" parasites. I lost the lot owing to my having to go travelling, most inopportunely, but I hope to do more on them later. They are probably a *Pheidole*. The Membracids (adults and nymphs) I found in a small Leguminous shrub at the base of a Palm, I think a *Tephrosia*, but it isn't flowering and I'm not quite sure. At any rate, it is the host of a very large number of Membracids, a much larger number of ants, and a few Lycaenid larvae. The larva, so far as I can make out, is without Guenée's gland and tubercles. It is rather bristly; the head protected by the usual "carapace." Its colour is a curious blend of the Membracid colour with additions. In appearance it reminded me very much of a large Syrphid larva that I found in Shagamu last tour eating Aphids, and that larva resembled a bird-dropping more than anything else. The young larva is rather more bristly than the older ones and is less "ornithoscatoid." The little shrub is only about three feet high, and I could sit down more or less comfortably to see what they were doing. In the forenoon I couldn't make out what they really were doing. I remembered enough of the "Relationships" to expect to

see a few trustful Membracids callously devoured, but failed to see the murder done. Then I went the round of other interesting trees and so home. In the evening I went back, having read up *Megalopalpus* about six times [Trans. Ent. Soc., 1913, p. 458]. After sitting for the best part of an hour with about twenty or more ants in most hostile association with each of my hands, one holding the branch and the other the shrub, I came to one or two conclusions.

In the first place, I failed entirely to find out what the adult Membracid gives to the ants, and, as far as this afternoon's work goes, I am inclined to believe that they give nothing at all. The species, whatever it is, is rather tame, and I had no difficulty in watching both them and the ants.

Secondly, the particular larvae that I watched this afternoon made no attempt to eat the Membracids. The adults wouldn't wait, I imagine, to be eaten, but the relation of the Lycaenid larva to the Membracid, was with the larval stage of the latter, and that I saw as clearly as possible.

The Lycaenid larva is very sluggish in its movements and hardly moved an inch from where it was when I came, all the time I remained. Whenever a Membracid larva came near it got busy and so did the ants. They all got busy in the same quarter, which was the upturned, retroussé end of the abdomen from which at fairly rapid intervals a short process was thrust out, on the top of which a clear droplet was simultaneously visible and instantaneously mopped up by the most enterprising of the suitors, which was generally the Lycaenid, in virtue of its superior size. Along with one or two ants it tickled with its anterior true legs the business end of the Membracid, but by "lolling" (in contrast with the extremely active habits of the ants), in a gross and unmannerly way, right over the orifice, it hardly gave the ants a chance. When an ant did get there first it generally shared, by regurgitation, the good thing with a fellow, and I am inclined to think on one or two occasions with the less gracious Lycaenid. But they showed no ill feeling if the latter got there first, and though all the time they kept biting me with great vigour—though the bite is little more than a fairly sharp prickling sensation—they showed no disposition to attack the Lycaenid. That is as far as I have got with this particular larva. I saw a mature ♀ Membracid ovipositing exactly in the

manner described by Lamborn [*ibid.*, pp. 495–97]. I saw two empty Lycaenid pupa-cases on the shrub, which annoyed me because I had missed them. I do not think it would be possible to feed such a larva in the house, as the Membracid probably wouldn't thrive on a cut twig.

One would think that it would be a long time before a comparatively large larva would mature on such fare, and yet it is probably a more concentrated food than many caterpillars get. In connection with the food of the "*Hewitsonia*" type of bark-frequenters [pp. 342–46] I have been examining the frass of various larvae microscopically, and it is to me a great wonder what they take out of the ingested matter. There is no question but what they feed on the "cortex," by which I mean just the thinnest superficial layer (including epiphytic Algae, etc.), for their bites are not visible to the naked eye, nor have I picked them up with a lens. The *Pterocarpus* larvae [p. 383] passed abundant frass which was practically unchanged corolla tissue, unchanged as far as the eye could judge. I took in some fairly large moth larvae [p. 407] the other day which were feeding on a fern epiphytic on an Oil Palm. They ate at a great rate and passed frass as quickly. Unless their digestive fluids are very highly concentrated and very rapid in their action, they could hardly take anything out of the plant tissue. So perhaps the Lycaenid with his Membracids is wiser in his generation than these seeming children of light. I hope to get them when about to pupate, to examine their frass too.

March 18, 1917.—I have now got several of the Lycaenids of the Membracid association to pupate. I have paid several visits since first finding the larvae. I'm sure now that Lamborn knew of it, for I recall him asking me if I saw any resemblance to a monkey's face in the pupa. [For Lamborn's observations on *Lachnocnema* see Trans. Ent. Soc., 1913, p. 470; but the supposed resemblance to a monkey's face is in the pupa of *Spalgis*, also proved to be carnivorous by Lamborn and others: *ibid.*, p. 475.] There is that suggestion certainly, but I think, at a little distance off, the effect is much more of the bird-dropping order, in a different way from that of the larva, for the colours are those of brown paper and putty, nicely blended. I tried hard to make more of their relation to the Membracids, but without success. I saw one once again feeding on the droplet but not on the Membracids, but my visits

seemed to coincide with resting—probably from repletion—periods. I succeeded, however, in getting several larvae on the point of pupation and have examined the frass microscopically. There could be no doubt about the presence of insect remains in it. I will send some in due course for your confirmation.

I found in one pellet a mass of asci with spores (a type with a mucilaginous covering), but I couldn't find any perithecium, and I cannot suggest as yet what the fungus may be or how it came to be there. It must, I think, have spored before leaving the caterpillar's body, for I put the larvae when found into perfectly dry new pill-boxes, and the pellets are so small and would have dried so quickly that I can hardly believe the fungus spored after extrusion of the pellet. I don't think there can be any doubt but that the larvae do actually eat the Membracids, which is rather low down. But at the same time they feed directly on the secretions of the nymphs. I am still puzzled as to what they or the ants get from the mature Membracids.

Jan. 26, 1918.—I got my Membracid-eater and secretion-drinker eating Jassids, as Lamborn did, on *Cassia alata*, and send one.

II. The mature Larva and Pupa of Catochrysops phasma Butl., from the Subterranean Nest of the Ant Camponotus maculatus F., var. melanocnemis Santschi: its young Larva feeding, with that of another Lycaenid (probably exhibiting Individual Colour-adjustment), on the Flowers of Solenostemon ocymoides Schum. and Thonn. (Labiatae).

[Material:—21 ♂ and 18 ♀ *C. phasma*, emerging Sept. 12–25, 1917, from pupae found Sept. 10 in débris of the ants' nest at Agege, 33 with precise pupa-cases. Emergence takes place at about 8.0 a.m. or earlier, as shown by the following data:—about 7.0 a.m.—1 ♀; about 7.15—1 ♀; before 8.0—3 ♂ 3 ♀; about 8.0—2 ♂ 3 ♀. With these, many pupae and two larvae in spirit taken at Agege with the pupae from which the imagines emerged; also Termites of three different genera (see p. 416) from the Termitarium in disused parts of which the *Camponotus* had made its nest. Also, from Moor Plantation, 3 ♀ imagines of *C. phasma*, ovipositing on flowers of *Solenostemon*, Aug. 5, 1918, and (two on the same plant), Aug. 11.

The discovery of the pupae in the *Camponotus* nest was at once brought before the Entomological Society (Proceedings, 1917, p. lxi, and 1918, p. lxxix, where the first determination of the Lycaenid as *parsimon* F. was corrected to *phasma* Butl.

The male armature of the *Catochrysops* has been examined by Dr. T. A. Chapman, F.R.S., and Mr. Bethune-Baker, who agree that the species is certainly *phasma* Butl. For a description of the larva and pupa by Dr. Chapman see pp. 490–93.]

Government Farm, Agege.

Sept. 10, 1917.—I have had a glorious find to-day. I set some men to clear the site of new labourers' lines. I went to see the progress of the work just as they were levelling what I took to be an old ant-hill (Termitary). The species of Termite is one that fastens on to large bush [forest] stumps and gradually converts them into a carton and mud heap, mainly carton, unlike *T. bellicosus* Smeathm., our commonest form, whose hill is entirely of clay. The colony was a feeble one, the material, I suppose, being more or less exhausted. But what I just arrived in time to see was, that in the abandoned carton portion *Camponotus maculatus* had established themselves. A fork thrust had just fetched out a mass of the nest, and amongst the débris I saw a number of pale-brown pupae, obviously Lepidopterous. I must make it clear that this fork-thrust went well below the ground-level, so that these pupae—and I found many more *in situ* in the mass—were actually subterranean, and they are Lycaenid pupae. I have seen the butterfly, for two or three emerged on the spot, a large blue form with spotted undersides and slight tails. The pupae were moth-pupa-like in colour, though rather pale or straw-coloured. I haven't counted, but I think I must have thirty of them, and not a few were accidentally destroyed. They all look as if they would emerge together. And I found two larvae about to pupate! They are of almost wasp-grub appearance, their legs and pro-legs being greatly reduced. I don't think they have either gland or tubercles. They had obviously stopped feeding, and it was useless to try them on the only likely-looking stuff there was, and that was Termite "bread." The nest had to be destroyed—it was ruined really before I arrived—but I think I'll be able to find others.

Do you remember that at Ibadan I once found a brown moth-pupa-like form associated apparently with *Camponotus maculatus* [p. 388]? I rather think you made it out as a somewhat abnormal form of *Lachnocnema bibulus*.

The huge soldiers of *C. maculatus* eagerly seized both pupae and larvae and carried them into concealment in the carton intricacies. I hope I may solve their food, but it may well be that they can tackle fungus growths on abandoned Termite bread left in the galleries. What strikes me as rather extraordinary is that this strange habitat would appear to be a safe one, for I'm sure there were in all fifty pupae, if I could have got them all, and the larva is soft-bodied with but few bristles. Now I will have to let this foreword do. I hope I'll get a good number successfully bred out. I ought to be able to send you the first lot next mail.

Agege.

Sept. 16, 1917.—My find might have been more complete, for I doubt if my first surmise as to the food of the larva is correct. On the whole I think it must be ruled out, but I may manage to get another nest of the kind sooner or later. It is something gained to know where to look. *The* nest was ruined before I came on the scene, and the wonder is I managed to get the material I did. It is all due to the fact that the present labourers' lines here are in the last stage of dilapidation and I determined to have new ones made. I got a new site selected which wanted some levelling. This I set the men to do. One has to be possessed of considerable versatility in a country such as this. I have done many strange jobs this tour, few at my own work. One can't leave the simplest bit of work to chance and a native headman, so after a time I went to see how the work was getting on and arrived in time to see two men driving forks into an old Termitary, part of which was already levelled. Little colonies of Termites with their fungus garden lay in the débris, and running about in great agitation were a large number of workers and soldiers of *Camponotus maculatus*. But what startled me more than these quite usual things was to see scattered about a number of golden-brown or straw-coloured pupae, which at first I concluded must be moth pupae. I concluded mentally that they might be worth having were it only for a seemingly gregarious pupation in rather an odd place. Then, perhaps because just a few minutes earlier

I had noticed a fairly large Lycaenid flying around, it suddenly entered my mind for no considered reason, I must confess, that they were Lycaenids. It was simply an inspiration. Almost simultaneously I saw the agitated *Camponotus* endeavouring to carry them to safety, and further I saw a newly emerged Lycaenid appear from, well nowhere, but I felt sure it was one of them. I saw another and I think a third as I hastened off to get tins, and warned off all labourers from the scene on pain of execution. I didn't get any of the butterflies and not a few of the pupae were badly damaged, but, with the exception of perhaps half a dozen or more that were hopelessly smashed, I took them all in and afterwards found I had brought in forty-one in all! I'm certain there weren't less than fifty pupae in that nest. I could do nothing to restore it and could only search the ruins cautiously for survivors of the wreck. I had great difficulty in separating the ants from the pupae. Two I discovered really by means of the ants. I saw two worker *Camponotus* trying to penetrate into the loose earth. There was no visible opening, but I thought there might be one beneath, and cautiously cleared away the particles of soil. About half an inch below I came on the two pupae. The ants rushed at them and proceeded to extricate them. I appropriated the lot. But I must go back a bit. The Termitary was of the carton type, part of it old and abandoned, and I am pretty certain had become secondarily tenanted by the *Camponotus*, though I couldn't definitely find the centre of the nest. There were neither larvae nor pupae of the *Camponotus*, only workers and the huge soldiers. But I abstracted a large mass of the carton nest and on it put a few pupae. Ants already occupied the carton material. The pupae were immediately seized and carried out of sight into the mass. I searched most carefully for Lycaenid larvae and found two, in loose soil. These also were eagerly carried inside the carton mass. The larvae were apparently replete and resting, prior to pupation. I could detect no glands nor tubercles, though, now they are in spirit, there is evident a slightly pigmented prominence in the region of the Guenée gland. The larvae are, to say the least of it, very grub-like, which is accentuated by their meagre pigmentation. The only colour was a faint pink, so faint as to be almost white. Where they may have been located in the original nest I cannot say. I think it most

probable that it was in the carton mass. It *is* a pity that the nest was smashed, but the only consolation is that had it not been smashed I shouldn't have found them. Any future ant-hill smashing that I do will be done most cautiously.' Since then I have probed about half a dozen similar ones, but only to find, besides the Termites, colonies of *Odontomachus haematodes*. But, after all, one can hardly expect such finds every day of the week, and I had to wait a long time for *Teratoneura*!

When the ants carried off the pupae and larvae I carefully broke off bits of the carton to see what they had done with them all. I had "allowed" them about half a dozen pupae. I found them all carefully massed together round a dried-out bit of Termite "bread." This led me at first to suggest that as the food of the larva, but on thinking it over I rather doubt it. I am more inclined to think, after looking at the extremely small heads of the larvae, that they are fed by the ants, unless the entire absence of ant larvae be accounted for by the Lycaenids having devoured their ova. That also I doubt. The larvae with glands, as far as I have seen, and I think Lamborn's results show the same, are generally phytophagous, anthophagous or suck sugary secretions. *Camponotus maculatus* I do not think is ever carnivorous, but haunts flowers in search of nectaries, leaf-glands and such-like, and has a perfectly distressing "scent" for one's sugar stores. It is quite likely that they innocently feed the Lycaenids by the ordinary process of regurgitation, and the Lycaenid perhaps does redeem itself from the slur of parasitism by a little return through the medium of the Guenée gland. An examination of the contents of the alimentary canal might throw some light on the subject (see p. 492).

Agege.

Sept. 17, 1917.—Seven emerged to-day or rather eight, the eighth being malformed. I have been most unlucky with malformations, having now about half a dozen. Several more pupae have simply blackened and perished, but till now I have fourteen practically perfect specimens, and I may with luck finish up with two dozen. It is very sad to lose so many, but I'm afraid it couldn't be helped. Anyhow, I don't suppose, since Lamborn's wonderful *Euliphyra* case [Trans. Ent. Soc., 1913, p. 450], so many butterflies have been bred out of a nest of ants. And of

course my find was a pure accident, and ought not to be mentioned along with such a wonderful bit of deliberate searching and finding as Lamborn's was. And of course if it hadn't been for Lamborn, the happy issue of this particular accident would have been lost. So I gladly dedicate them to my friend.

I mentioned that I allowed the ants to carry pupae into the concealment of the carton labyrinth, from which I afterwards abstracted most of them. A few I left in the hope that I might see how the ants behaved subsequently. I wondered if they assisted the imagos (or should I say imagines?) to emerge. Unfortunately I have quite a lot of other work to do, and in my absence two or three came out. I got back in time to rescue one which was caught by a leg by a worker ant. What I took to be the disintegrated remains of two I discovered under the carton mass, but they may have been devoured by the white ants which still were present. Later on another got caught by an ant and had to be rescued, and, as I really couldn't get the time to look after them continuously enough to make useful observations, I was forced to separate them entirely from the ants. Yet in nature these newly emerged butterflies would have to run the gauntlet of not a few easily excited and suspicious ants, and I am greatly disappointed at not being able to throw any light on the problem. I can only hope that I may one day see a newly emerged Lycaenid crawling out of the opening of a *maculatus* nest. There will be no scope for "profane" labourers with forks. Escape may be facilitated by the fact that *maculatus* is, as I think I told you [pp. 423–25], of nocturnal habits.

Agege.

Sept. 18, 1917.—Five perfect and one malformed emerged to-day, which brings my total of good specimens up to nineteen. With anything like good luck I ought to manage two dozen and perhaps one or two more. I have to go to Lagos to-morrow and will be there two days. However, I'll take them with me. I am putting up at the Medical Research Institute, where they will be looked after while I carry out the purpose of my visit, which isn't a very exciting one and is on the whole a most irksome one.

Agege.

Sept. 27, 1917.—The mail is announced for to-day. The train service is suspended owing to floods, but I am sending

a boy to Lagos with this and a box with a few of the great find. I am so pressed for time that I had to take a few at random from the box. I will send the rest in small lots so that they may not all be torpedoed at one Hun effort. I have also sent one larva and one tube with Termites.

Agege.

Oct. 18, 1917.—I will now give you a few notes of the things I have posted for this mail. To begin with I have sent a second batch of the *maculatus*-Lycaenid with pupa-cases. The boat they will go by is an old and none too speedy one, but one that has had the most wonderful submarine adventures and got through. On one occasion she fought the enemy for six hours, was missed by four torpedoes and sank the enemy. That is no romance—except in the best sense. So I am in hopes that you will get my Lycaenids.

Agege.

Oct. 20, 1917.—I hear the R.M.S. "Mandingo" (originally "Appám") has got home, and on it were the first of the *maculatus*-Lycaenids.

Moor Plantation.

Jan. 26, 1918.—[After describing the final consignment of *C. phasma.*] Then you got some pupae in spirit which failed to emerge, so you may now total up the lot. And I think you may safely allow ten more for unfortunates that were squashed in digging out the ant-nest, besides the two larvae, and you will know the wonderful total.

Jan. 12, 1918.—A mail arrived here yesterday which brought me a proof copy of the foreword (Proc. Ent. Soc., 1917, p. lxi), and also the news that the *Catochrysops* may *not* after all be "*parsimon.*" I hope its real name will be worthy of such an enterprising animal.

April 17, 1918.—*Catochrysops phasma* rather pleases me—much better than "*parsimon*," a dreadful combination of indifferently classical Latin and neglect of observation [see also p. 325].

Aug. 11, 1918.—What with adding up yards of wretched money columns I was in doubt if I could catch the next steamer home. So heartily sick of the work was I that my whole outlook was one of unredeemed pessimism, but the other day something happened which made me wish for another month here at the risk of missing September in

Scotland. I have a milch goat, a somewhat perverse animal. One afternoon it cried so very persistently that I went outside to see what could be wrong. I could find no evidence of anything but perversity, and was really feeling most annoyed, when I suddenly saw a *Catochrysops*-like Lycaenid deliberately oviposit (I felt quite sure about it) on a weed in my compound—a *Labiate!* [*Solenostemon ocymoides* Schum. and Thonn.] The plant is the one from which Lamborn bred *Precis octavia*. It is an almost scentless plant. I knew of *Ocimum viride*, the so-called mosquito-plant, and had looked at it for Lycaenid ova, but without success. *O. viride* is a W. African plant (it yields thymol) the scent of which was supposed to be a mosquitifuge. It is commonly found in native villages. It doesn't seem to have entered the minds of those who boomed this plant as a terror to the mosquito, that the absence of mosquitoes from villages where the plant grew (if indeed they are ever absent) might equally well be due to the normal so-called "bouquet d'Afrique," which at times takes forms that might knock out the stoutest mosquito.

I do not know if the Lycaenid I've got is *phasma*, for I have kept no type. [It is *phasma*.] Anyhow it is just as well, for it gives me no bias. The egg is most cunningly placed inside the small flower on the lower lip of the corolla. For a Lycaenid egg it is quite large and of a pale blue colour. I have just looked at the first set of inflorescences on which the specimen caught on the 5th (it was Bank Holiday) oviposited. I only found two ova and those with difficulty, for the swollen nectaries, which secrete at a great rate even when the flower is cut, are rather like the ova, and I think I must have overlooked some, for I now find there are about half a dozen unmistakably Lycaenid larvae, tiny little things and rather bristly, one of a yellowish colour, the others red-purple like the flowers. I wonder if I'll be able to do anything with them before I have to sail. Of course they may not be *phasma*, but I think, if the Lycaenid completed its whole existence on the plant, that Lamborn would have found them. Plants are difficult to dry at this time of the year, but I'll send a specimen in spirit for you to send to Kew. I am also to send the *Loranthus*. [Both sent on the following day, Aug. 12.]

[Dr. O. Stapf of Kew informs me that *Solenostemon ocymoides* ranges from Senegal to the Congo. It is very

closely allied to *Coleus*, the recognised food-plant of *Precis*, so it is not surprising that Mr. W. A. Lamborn should have found the larvae of *P. octavia* upon it (p. 399).]

It is in a way rather unlucky that I should have to go home, but it will be about a month before the next boat goes, and I may have some luck in the interval. Anyhow, if the wretched Boche doesn't get me it will be a nice problem to come back to, and if the aforesaid Boche does get me, perhaps Lamborn will supply the missing link. I think the fact of the oviposition being *on the flowers* is significant. *Camponotus maculatus* is a notorious nuisance in sugar cases. They are always crawling about flowers, and I think it likely that the food of the *phasma* larvae in the *Camponotus* nest must be regurgitated nectar. Of course they might turn carnivorous at the next stage, but I've little doubt that, given a chance, I ought to be able to clear it all up. It is only a matter of time.

Aug. 25, 1918.—I told you about finding the Lycaenid (possibly *Catochrysops*) ovipositing on a Labiate plant. I now have a lot of young larvae, but they will not be mature before I sail. However, I am to ask Dr. Connal to follow up their life-history, if it can be followed. In trying to find fresh food for the larvae I have had difficulty in finding plants *without* tiny larvae already feeding on them, and the butterfly, whatever it is, is busy all over some of our more weedy plots. I have of course but a somewhat dim recollection of *phasma*, and more than probably I am on another butterfly altogether, for two larvae have pupated! So far I have only seen one type of butterfly (those sent to you) ovipositing, but somehow the pupae seem to be too small for that type. I have been able to provide abundant "chop" for the larvae, and the pupae cannot be small on that account. But the larvae are very variable in colour. If the inflorescence on which they feed is rather young and predominantly green, the larvae are green and red. If the inflorescence is predominantly reddish-purple, with mature, fully opened flowers, the larvae are reddish-pink, and when very young, extremely difficult to pick out among the tiny hairy flower-stalks which they closely resemble. Those that pupated were mostly green, with hints of red round the margin, but they "went up" on a green leaf. The pupae are distinctly bristly too. I wish I could have stayed another month, but it is no use trying to get it. They'd think I was funking

the sea, which I do in a way, but not enough to reduce me to make them think I felt like that. However, it is quite likely that the plant grows in East Africa and maybe *phasma* is there too, or whatever form I've got, and Lamborn will know the host-plant of *Precis octavia*. He will be able to clear it up if I never get another chance.

Lagos.

Aug. 31, 1918.—I sail to-morrow morning. Two days ago, or rather a day or two before that, I had decided that I had two sets of larvae on the Labiate, one green or reddish or both together, of which four pupated. Two of these have emerged, and they are a small and very pretty form. The other set are reddish *only* right through, but have grown very slowly. They are by far the most common. In fact, every plant one picks carries a few. None have pupated, and I begin to think they won't. Some have died of a fungus disease (in one only of my tins), but one of the other type also died.

I sail to-morrow morning, but I am to see Dr. Connal this afternoon and he will be able to tell you the sequel. It is very bad luck that I should have to go just now, but it can't be helped. I feel sure that they are *phasma*. I actually found a *maculatus* which had got caught by a spider on one of the host-plants, but it was dead. The worst of it is that the *Camponotus* is a "night hawk," and one seldom sees them at all in the day.

Now I must close. I do hope I'll get the chance to complete the life-history myself on my return.

Yours sincerely,

C. O. Farquharson.

[These were the last words I received from my friend. There can be no doubt that the larger larvae were *C. phasma* and that they are carried by the ant to its nest to complete their development. The imagos of the smaller Lycaenid, which lives throughout larval life on the food-plant, were probably taken on the "Burutu" and lost. I have tried but failed to receive any communication from Dr. Connal concerning the material left with him by Mr. Farquharson. It is probable that the smaller Lycaenid larvae possess the power of individual adjustment to the changing colours of their food-plant, in this respect resembling those of *Lycaenesthes lunulata* (p. 386).]

III. MISCELLANEOUS OBSERVATIONS ON RHOPALOCERA.

A. Notes on breeding certain Nymphalinae.

1. *Charaxes etheocles* Cr.—[An account of the series of specimens, with male-like females, bred by C. O. Farquharson and W. A. Lamborn, has been published in Proc. Ent. Soc., 1918, p. lxxxiii.]

Oct. 16, 1915.—The larvae were obtained from the same plot of *Adenanthera pavonina* at Moor Plantation. I have rarely seen more than one or two at a time.

July 26, 1915.—I have five *Charaxes* pupae just now, but this will be the last for a time, for the young trees on which they feed are being transplanted. These trees also one day were raided by drivers. The place is simply alive with them just now owing to the dull weather.

2. *Charaxes varanes vologeses* Mab.—[The bred specimens referred to below are a male, emerging June 22, 1917, and a female which pupated June 12.]

Oct. 18, 1917.—I had rather a bit of bad luck over them, for I chased the mother all over a ten-acre field of ground-beans between the burning hours of 11 and 12 noon, only to lose her. I raised three from the eggs I saw her lay before I got home for my net. However, I may have better luck next time.

3. *Palla violinitens* Crowley.—[The following note, written from Kew, almost certainly refers to a female of this species labelled with Farquharson's initials, but no other data. Its position in the Moor Plantation collection proves that it was bred or collected in 1913 or 1914.]

Oct. 20, 1914.—I bred out a very nice *Charaxes* before leaving, or rather it was a pupa when I left and a friend sent it on. I do not know the name of the host-plant, which had at the time neither flower nor fruit, but may know it again. The larva had purple blotches on the skin.

4. *Euphaedra ravola* Hew.—[Of the bred specimens referred to, 1 ♂ emerged Aug. 22, 1915; 1 ♂ 5 ♀—7.0 a.m. Aug. 23; 1 ♀—Aug. 24. All have precise pupa-cases. Six families of this species were bred by W. A. Lamborn at Oni and the resemblances between their larvae and those of several other Nymphalines recorded in Proc. Ent. Soc., 1912, p. cxix.]

Sept. 28, 1915.—The Euphaedras were found as larvae in a company on their host-plant. They were a curious chocolate-brown colour with processes like those of *Hamanumida* or *Aterica* of a vivid sulphur-yellow colour, which gave them rather a fearsome look.

5. *Harma* (*Cymothoe*) *theobene* Dbl.-Hew.—[The material, bred in 1915, includes 3 ♂ emerging Aug. 1, 9, 11; 2 *nigrolutescens* ♀ forms (p. 469)—Aug. 4, 21; 2 *theobene* ♀ forms—Aug. 10, 11. The ♂ and ♀ of Aug. 1 and 4 pupated July 22 and 26, respectively. All except the ♀ of Aug. 21 have precise pupa-cases. For an account of the ♀ polymorphism of this species and Lamborn's families from known female parents see pp. 469–72.]

Sept. 28, 1915.—I am most interested in what I think must be a *Cymothoe*. The caterpillars were all found on the same host-plant in the bush, and were all identical. There would appear to be three imaginal forms.

6. *Neptis nemetes* Hew.—[Two specimens with precise pupa-cases were sent, bred from larvae found on the same plant in the bush :—1 ♀, emerging 1.0 p.m., Aug. 11, 1915; 1 ♂—Aug. 12. The ♀ pupated Aug. 1.]

7. *Acraea lycoa* Godt. and *A. pentapolis* Ward.—[A bred series of *lycoa*, 2 ♂ 4 ♀, emerging Aug. 22, 1915; 2 ♂—Aug. 24 and 25, these two latter with precise pupa-cases. One ♀ *pentapolis*, emerging Oct. 2, 1917, from a pupa found at Agege.]

B. The Under Surface of the Nymphaline Butterfly Crenis amulia Cr.

[The following letter was written from Kew. Two specimens are labelled "Aro-Chuku 13.v.14," the third, undated, "E. Prov. of S. Nigeria. Bonny, Aba, Aro-Chuku, Azumini. Butterfly showing *Hamanumida*-like variation." The resemblance to a common form of the variable under-surface of *Hamanumida daedalus* F. is certainly strong, and it is probable that Farquharson was suggesting mimicry of the abundant by the rarer species. It must, however, be remembered that *daedalus* could only act as a model during the daylight hours of complete rest. In the intervals of the active state it invariably rests with expanded wings, as Farquharson well knew (Proc. Ent. Soc., 1914, p. xxxix).]

Oct. 26, 1914.—I am sending three butterflies—not in good condition, I regret to say, and to be effective I ought

to have had more. They seemed to me as I watched them in passing through the districts where I saw them, to show under-surface variation recalling that of *Hamanumida daedalus* very markedly. Perhaps this feature of this particular species is well known to you, but I am not sure whether I have heard Dr. Lamborn mention them.

C. The Migration of Libythea labdaca Westw., at Moor Plantation.

[For further observations on the migration of this butterfly in W. Africa see Proc. Ent. Soc. Lond., 1916, p. iv; for that of *L. laius* Trim., in B.E. Africa, *ibid.*, 1912, p. xcvii; 1921, Swynnerton, p. lxii; and of *L. bachmanni* Kirtland, in Texas, Ent. News, Oct., 1917, and E.M.M., 1918, p. 16. I wrote to Farquharson about the inconsistency in the direction of flight in his letter of May 3, 1917, but this was one of the subjects he had left to discuss during his leave. Fortunately, however, his letter to Dr. Hill leaves no doubt about the interpretation.]

March 20, 1915.—It has been dry since I came out till within a few days ago.

To-day the migration of the Libytheas has been in progress for more than two hours now. A constant stream of them has been flying across the station in a S.S. Westerly direction. I have now seen this migration three times, and each time it has been in the same direction. I am not sure if the seasons have corresponded, but I rather think that is so. The particular species is not very common here ordinarily, if anything they are uncommon. I have only seen them a common species in one place, at Aro-Chuku in the Cross River district, near Itu, which is N. from Calabar.

May 3, 1917.—The northward [southward] flight of the Libytheines took place yesterday and the day before. In some places the natives take the appearance of the migrants as a sign that the planting season for such crops as maize and other annuals has begun, which is equivalent to saying that the rains have definitely set in. They go southwards [northward] again at the end of the season. This year the flight is late, for I recall that when I laid down the ground-nut experiment which led to the discovery of the Mylabrids, about mid-April, the flight was then in progress.

It is curious that these inconspicuous almost cryptic

forms have the queer habit of settling in great numbers on white-washed culverts, white stones and such things, where they are most prominent. [See Swynnerton in Proc. Ent. Soc., 1921, p. lxiii, for evidence that *Libythea* seeks some chemical substance.]

[Mr. Lamborn agrees with me that there can be no doubt that "southward" and "northward" were accidentally transposed in the above letter. As the passage stands it is inconsistent with the letter of March 20, 1915, and also with the following, written by Farquharson Aug. 23, 1918, to Dr. A. W. Hill, F.R.S., and published in Roy. Bot. Gard. Kew, Bull. No. 10, 1918, pp. 355, 356.]

"Early in the rains for two or three days thousands of migrating Libytheine butterflies pass here flying southwards. The negro peasant knows that after that he may safely sow his cereal crops—maize, at any rate. Towards the end of the rains swarms of the same butterflies return northwards. One may conclude that the rains are over. Between the flights to and from the forest belt we never see them."

D. A Lycaenid False-head-like Appearance produced by two Pierines in coitû.

[The attitude described was roughly illustrated in the following letter, but it is somewhat difficult to understand. In order that the antennae of the butterfly enclosed between the wings of the other should alone be visible it is necessary to assume that the abdomens are sharply bent into an S.]

Aug. 11, 1918.—I read with special interest that theory about the false "head" of Lycaenid butterflies. I hope you will not imagine that I was wise after the event, but the theory brought to my mind a curious error into which I fell a day or two earlier. On a plant in my garden I saw what I thought was rather a large white Lycaenid that I'd never seen before. With the exception of things like *Catochrysops*, few Lycaenids come up to the clearings round our quarters, most of them preferring the bush near the river. I was quite surprised at such a fine large one with rather long tails. Having no net I put out my hand to grasp it, but "it" flew away. "It" was really two moderate-sized Pierines *in coitû*, which had settled down on the plant. I wish I could draw their position, but you

will perhaps realise how things were from my rough sketch, [showing the] antennae of the second one [projecting behind like tails], the wings being quite invisible, enclosed by the wings of the first. When they took to flight the illusion was, of course, obvious, but when they were at rest, and I was not looking for anything in particular, I was completely taken in. I was so surprised that I hardly noticed which of the Pierines it was, but I shall more than probably see the same thing again. The memory of the incident, however, made me read the false-head theory with great respect.

E. A remarkable Larva, probably Papilionine.

Mar. 2, 1918.—One evening about a fortnight ago I was looking at the small fruits of a tree growing by the river side which I had been told were edible. The tree is, I believe, a Sapotaceous one, of the genus *Pachystela*. I noticed a very subtly cryptic larva, of a dry earth-brown colour, resembling a dried-up catkin more than anything else. Its attitude, with head and front thoracic region lifted, so that the larva stood on its pro-legs, made it rather moth-like, especially as it had rather a long gap between the last pro-legs and the clasper hind "feet," and this posterior region was also held up. I took it in and it fed readily. Its frass was rather characteristic, consisting of fairly large pellets, hollowed out so that when dry they looked like small air-gun lead caps or pellets. At the next moult the larva was more remarkably coloured. It had clubbed spiny processes on it even when first I saw it, and these became more pronounced, but the colour changed to a wonderful mottling of green and brown with little hints of red. You may be sure I was glad to see it pupate to a swallow-tail type of pupa, but the next day the pale green pupa turned black and shrunk and is, I think, parasitised. What is worse, I cannot find any more, but the tree is fairly common and I may, unless its season is just over.

F. The Hesperid Rhopalocampta forestan Cr., probably absorbing Salt.

[The following note, additional to those published in Proc. Ent. Soc., Lond., 1916, p. lxxx; 1917, p. lxxviii, is quoted from one of Farquharson's letters.]

Government Farm, Agege.

Dec. 15, 1916.—I have since seen *Rhopalocampta* doing the same on the cement floor of the office verandah. I didn't notice any spots [of perspiration] at the time. The chair, on the arm of which I saw the butterfly [Proc. Ent. Soc. Lond., 1916, p. lxxxi] was an old one. It is possible that the surface, from one's habit of involuntarily perspiring in this country, might be rather saline, but I'll try to get further observations. My first one was lucky, for the action was so prolonged. I had no difficulty whatever in seeing what was taking place.

IV. MISCELLANEOUS OBSERVATIONS ON HETEROCERA.

1. *Elaeodes brevicornis Walk.: Noctuidae, Acronyctinae* (*Diphtherinae*).—[The material of the following note includes 2 ♀, emerging about 5.0 p.m. and after 6.0, Mar. 18, 1917; 3 ♂ 2 ♀ (with cocoons)—Mar. 19; 2 ♂ 1 ♀—Mar. 20. The next species *E. acatharta* Hmpsn., in the British Museum collection, is accompanied by pupa-cases and preserved larvae. The larvae appear to be even more conspicuous than those of *brevicornis*, but the pupae less so. The cocoons of both species are very slight so that the pupae are visible.]

Mar. 18, 1917.—Two of the fern-feeding moths have emerged to-day, one about 5 p.m., the other after six. I can't say the exact time as I was out when the second came. It is rather a pretty moth. The larva was about an inch and a half long, of somewhat "loud" pattern, being striped dark brown, almost black, and yellowish white, with translucent brown, ventral surface. In spite of their rather formidable appearance they were rather timid, and dropped to the ground when disturbed. The body had very sparse hairs. I took a dozen larvae—as many as I could reach—all of which pupated in the next two days. They bound one or two of the fern pinnae together with silk threads, but not by any means elaborately. The pupa itself is rather a bizarre, brown-and-yellow-coloured object. I collected them because it struck me I had not seen many larvae—Lepidopterous at any rate—feeding on vascular Cryptogams, but it may be quite common.

2. *Eublemma scitula Ramb.: Noctuidae, Erastriinae.*—

[Two examples bred May 14, 1917, from larvae feeding on *Aleurodes africanus* Newst. (p. 528) on the under surface of leaves of *Salacia* sp. (*Celastraceae*), in Farquharson's compound. The plant, which Farquharson thought to be *Anona muricata* L., was determined by Mr. T. A. Sprague of Kew.]

3. *Selepa leucogonia Hmpsn. : Noctuidae, Sarrothripinae.* —Two examples, one bred Nov. 1, 1917, the other probably in the same month, from larvae feeding on Wine Palm Scale.

4. *Bareia incedens Walk. : Noctuinae.*—One moth " bred from fairly large, pale green larva, found Feb. 21, 1917 (spun Feb. 22), on leaves of Lycaenid tree," *Alstonia congensis.*

5. *Two remarkable Larvae, Geometrid (Hemitheinae) and Notodontid (Stauropus).*—[Both were received in alcohol. The extraordinary Geometrid larva is described and figured by Dr. Eltringham (p. 487). The Notodont larva is evidently allied to our *Stauropus fagi* L., and the mimetic resemblance is of the same kind, although carried further in that the posterior part of the larva, being coloured green, represents the prey and the anterior part, the ant attacking it. The remark of the " boy " supplies interesting confirmation. In the later stages of *fagi* Portschinski suggests that the caudal shield represents a Pentatomid bug, and the rest of the caterpillar its victim (" Coloration marquante et Taches ocellées," V. : St. Petersburg, 1897, pp. 44 et seqq.). For the ant-like appearance of the young *fagi* see Linn. Soc. Journ. Zool., vol. xxvi, 1898, pp. 589, 590, pl. 40, fig. 1. In Farquharson's specimen the head, true legs and anterior segments are black, like an ant, while the green colour begins abruptly with the 3rd abdominal and is continued backwards to the caudal shield, which, of a brownish tint, doubtless represents the head of the victim. The two long slender caudal filaments lie along the ventral surface of the shield. The 1st and 2nd abdominal segments bear a pair of long, sharp, backwardly curved processes, one on each side of the mid-dorsal line. They are beset with short, sharp spines.]

Agege.

Oct. 18, 1917.—Yesterday was a day of surprises. I found a looper larva that looked exactly like a small centipede, that is, it was dorso-ventrally flattened and had extraordinary processes along its sides, or rather developments

of the segments. It was not on its food-plant, and I think I will have to kill it without knowing what it is. Finally, my boy brought me a curiosity. It looked like an ant (a black one about the size of a *Camponotus* (*Orthonotomyrmex*) *sericeus* F.) in the act of engulfing, in a thoroughly un-ant-like way, a green caterpillar. "What on earth is this, Joe?" I asked. Said he, "I think some ant ketch 'um." Then I found it was all one animal. I remembered a picture in Shelford [lowest fig. on pl. xvi, facing p. 230 of "A Naturalist in Borneo"], and to-day I found in Lefroy's "Indian Insect Life," p. 472, a picture of a Notodontid larva [*Stauropus alternus*] which, I think, must be of the same genus. Looked at closely, of course, it isn't a bit like an ant, but more than likely it is the first impression that is the saving impression. The enemy in nature is not going round with a Zeiss pocket lens magnifying so many diameters.

6. *Ereunetia fulgida Warr.* : *Geometridae, Boarmiinae.*—[Mr. L. B. Prout considers that Warren's *flava* and *currifera* are synonyms and his own *orientalis* a geographical race of *fulgida*. A single male was captured, attracted to a lamp, July 12, 1918. Farquharson noted that, in the resting position, the wings are held upright over the back, as in many Geometers. Farquharson was here doubtless referring to the brief rests between the flights —not to the position assumed in prolonged rest. This moth is an interesting addition to the great group mimetic of Lycid beetles (Trans. Ent. Soc., 1902, pp. 515–18; Proc., 1918, pp. cxxxviii–cxlii.)]

7. *Parasa viridissima Holl.* : *Limacodidae.*—[Two moths bred Dec. 19 and 20, 1917, from larvae feeding on Coconut Palm at Awka, 22 miles E. of Onitsha.]

8. *Margaronia prasinophila Hmpsn.* : *Pyralidae, Pyraustinae.*—[The following note by Farquharson, together with the ♂ Pyrale (both numbered 477), was sent to me by W. A. Lamborn.]

Feb. 4, 1914.—On entering my house the other day, Jan. 29, 1914, I observed a pale green Pyralid moth on the wall of my room. This was about mid-day, and the moth was in a position of rest. On my approaching for a nearer view the moth moved slightly, evidently in alarm, though without attempting to take to flight. At the same time, too, from its posterior end a tuft of dark hairs was exserted, and the tip of the abdomen rotated rhythmically from side to side, the hairs remaining extruded all the while.

I captured the moth by putting a glass over it, and put it on a side table where I could observe it more conveniently. During this operation the moth was of course violently agitated and fluttered about inside the glass, ultimately, however, settling down. From a position which I judged to be invisible to the moth I observed that the rotation of the abdomen with its extruded tufts continued for some time before the normal position of quiet rest was assumed.

By disturbing the moth inside the confined space of the glass, I tried to discover whether any odour was emitted, but unsuccessfully. I do not, however, lay stress on this, as my olfactory sense may have been at fault.

9. *Mnemoses farquharsoni Durrant, gen. et sp. n.* (p. 494): *Tineina, Hyponomeutidae.*—[Material:—Fifteen moths, with precise pupa-cases, 2 bred Oct. 2, 1917; 12 (3 in British Museum)—Sept. 23–Oct. 11, 1917; 1—Jan. 17, 1918, from larvae in silk web as described below. Also 3 webs, and examples of larvae in spirit. From the bark of Pará Rubber, *Hevea brasiliensis* Müll. Arg. (Euphorbiaceae), at Agege. None of the parasites mentioned were received.]

Agege.

Sept. 27, 1917.—I have also sent two little moths labelled Pará Bark Moth of which I will write you later. I regret to say I took the larvae for Coleopterous specimens, but they spin a protecting web like Embiids except that they dust it over with fine sawdust. They live on the outer cortex and are quite harmless, only all Pará trees crawl with *Oecophylla*—or bristle with them I think would be a better term—which are constantly running up and down, over the "webs," so that, in a way, this little moth gets over *Oecophylla*.

Agege.

Oct. 18, 1917.—I also sent some more specimens of the Pará Rubber bark-feeding moth. I hope some of them will get home with sufficient scales on them for diagnosis. I tried folding back the wings and failed utterly. The other way could hardly be more ruinous, but I will have a further try. I fear I suffered from nerves. With the specimens I sent a piece of the extraordinary web they weave. For such tiny moths, their achievements in this way are rather remarkable. The Pará tree from which that substantial piece came was covered nearly all round for 3 or 4 feet

of its length, from about 5 feet from the ground upwards, and the circumference of the stem would not be less than 25 or 30 inches. For the most part the web is of single texture, but the larvae appear to pupate gregariously, and over the place selected for pupation the web is several layers thick and each pupa is immediately surrounded by a very tough piece of the fabric. I have bred out quite a number and found no parasites. I may say, too, that Pará trees here are almost without exception infested with *Oecophylla*, and I am sure give rise to much "bad" Yoruba among the tappers. *Oecophylla* is a most unreasonable animal, hardly ever waiting to be attacked. Unconsciously I should think they do much to protect these little moths, for they run freely over the protecting fabric and few other things share their hunting-grounds. How the little moth gets out is a question I cannot answer. The first larvae I found were under rather an old dilapidated fabric, and I thought they were some sort of Coleopterous type. I ought perhaps to add that there are normally on Pará trees brown patches of bark, free from lichen, which are difficult to tell at a distance from the web of these moths—really difficult to tell.

Moor Plantation.

Jan. 8, 1918.—During the week-end I was at Agege. I had to go down and pay the men, besides checking two months' rubber yield, so that, as I only got down on Saturday—6 hours in the train—and back here yesterday, I had to work most of Sunday. I managed, however, to secure some excellent specimens of the Pará moth web, which I will send next mail. I can't get time—indeed, haven't quite enough material—to send this mail. I also got cocoons of a Hymenopterous parasite, but so many are hyperparasitised that I doubt if I'll get a specimen of the original. I saw quite a dozen tiny Chalcids or Braconids on the surface of one web. I also found a few Dipterous puparia, but practically all parasitised. It is the larva that is attacked.

May 28, 1918.—While at Agege I had a hunt for the little Pará moth parasites. They are a Dipteron of some kind and an Ichneumon, but I couldn't find one that hadn't been parasitised in turn by a tiny Chalcid or Braconid. The latter I frequently found inside the "web." I am in hopes that I may yet get the original parasites, for the moth is very plentiful at present.

B. MISCELLANEOUS OBSERVATIONS ON INSECTS.

I. APTERA: COLLEMBOLA.

May 3, 1917.—P.S. again. If Lamborn is at Oxford I wonder if you'd ask him whether he ever did anything with curious very tiny blue-black wingless insects that appear at this season after the early rains. They are gregarious and occur in vast numbers, so that they look like a mass of bluish "soot" on the ground, or like a great splash of ink. They pass over the ground in a wave, sometimes many yards long. I have never seen what I consider would be the mature forms, but I must send you some. When you disturb the mass they rise and scatter, like a film of smoke—of course, only rising for an inch or two above the ground.

[Specimens collected by Mr. Lamborn at Moor Plantation (May 17, 1914) have been determined by Prof. G. H. Carpenter as *Isotomina* 12-*oculata* Carp., the species from Nyasaland referred to below. Prof. Carpenter has kindly written:—]

"*April* 27, 1921.—I think that you should certainly publish the note, as we have so little information about the bionomics of tropical Collembola. This habit of crowding together is, of course, well known with respect to many British and European species—such as *Podura aquatica* on the surface of ponds, *Anurida maritima* on tidal rock pools, and *Achorutes socialis* on Alpine snows. The species of *Isotomina* from Nyasaland, described in Sci. Proc. R. Dubl. Soc., vol. xv (N.S.), No. 39, p. 543, must be a markedly social insect, as there were hundreds of specimens in the collection, and the same may be said of the antarctic *Gomphiocephalus hodgsoni*, which the naturalists of the second Scott expedition found in swarms on frozen pools and among snow in S. Victoria Land. (My paper on this is now in the press among the 'Terra Nova' reports.)"

II. NEUROPTERA.

A. Embiidae.

Notes on Embia (Rhagadochir) apicata Silvestri, sp. n. (p. 449), *and a larval Embia on Cotton-seed Sacks.*

Material:—Two ♂, 2 ♀ from webs on the Pará Rubber trees at Agege; the ♂ ♂ bred at Moor Plantation and referred to as sent off in a letter of March 23, 1918, the ♀ ♀ sent from Agege, Oct. 1917. Webs of the same species from Agege, sent Feb. 8, 1918. Also 4 larval Embiids from webs on cotton-seed sacks at Moor Plantation and web-covered sacking from the same store, referred to in a letter of Aug. 12, 1918. Farquharson considered that these latter were distinct from the Agege species, but Prof. Silvestri thinks that they are probably the same (p. 450).]

Government Farm, Agege.

Dec. 15, 1916.—There are one or two species of Embiids about here. They are extraordinary. Their "reversible" gear must be most efficient, for they can run backwards or forwards equally easily and rapidly.

Agege.

Oct. 18, 1917.—I thought at the same time [as the observations on the moth larvae, p. 410] it might be worth while to note any other insects that share the Pará Rubber trees with *Oecophylla*. One variety I have long noticed and always intended to send. I hope to send some soon. These are Embiids. There are several trees here that are covered round and round their stems up to the forks (about 10 to 12 feet) with a glistening felt of silk, which gives them in a half light a curiously ghostly appearance. On closer inspection the web is seen to cover an extraordinary network of "tunnels" of much denser opaque fabric, but the insects do not confine their journeyings to these thicker-walled tunnels, but can easily be seen under the general covering web. I once saw a winged one, but lost it, and have never seen another; but I recollect still that the wings were of a blue-black colour and somewhat lustrous like those of some wasps. I am in hopes that I may get winged forms again, for the species, whatever it is, is quite common on the Rubber trees—*Oecophylla*

notwithstanding. They are really most extraordinary creatures with a perfectly amazing faculty of running backwards or forwards at will. They prefer the normal way, however, and turn themselves with astonishing ease in little space. When they run forward the hind legs appear to be more or less passive. On such a tree as I have described there must be enormous numbers. I am not exaggerating. The silk has a peculiar, sort of moonstone lustre, or might be compared to a vast snail-smear though composed of threads, and the "vanishing tree" effect is really quite striking.

Moor Plantation.

Dec. 12, 1917.—I have also sent one or two Embiids.

Jan. 26, 1918.—The Embiids feed on the dead cortex—possibly for the lichen—of Pará Rubber trees. I have a few with wings developing.

Feb. 8, 1918.—I send a box with Embiid silk. It is difficult to get a good specimen—it is so fine. You will see the frass in the silk, but the frass seems to be concentrated at certain centres where the silk is several layers thick, not unlike the thickened part of the little moth "mat." At these padded parts, too, the young seem to congregate. I will write a full description of some of the curious habits of the Embiids.

Feb. 14, 1918.—I hope to get some interesting things about the Embiids. I believe they show the beginnings of social life—more than the beginnings, in fact. The Embiids feed on the dead cortex of the rubber tree. There is no doubt about that either. And there must be hundreds on a single tree, all under a common silk covering. I don't exaggerate when I say that I have seen 10 or 15 feet of the bole of a rubber tree, not less than 30 to 35 inches in girth, covered round and round with the silk. *Oecophylla* can walk over it but cannot get into it. Under the general web are thickened, practically opaque silk tunnels that converge at large "junctions" where even the general web is several thicknesses. Under these thickened portions the insects, especially the young ones, seem to collect. The whole thing looks like a map of the tube railways, the lines being of thick opaque silk and the whole overlaid with a thin but impenetrable (to other insects) film of semi-transparent silk. The "lines" are not, I think, tubes but simply portions thickened for more effective

concealment, perhaps in the daytime. There are lots of points to clear up, but every time I go to Agege I'll get a little more study put in.

March 2, 1918.—My Embiids haven't got their wings fully developed yet, so they are not sent. I hope they will get home all right.

March 23, 1918.—I have nothing to send this mail, for I have been very busy, but I've got a winged Embiid, the wings blue-black and slightly lustrous as I remembered seeing once a long time ago.

July 19, 1918.—I have found a most populous and prosperous species that lives in bags of cotton-seed, the tunnels and greater part of the web being on the outside. It will be as easy as possible to send you really great specimens. A British Cotton Growing Association's store near by, which is full of bags of cotton-seed, simply swarms with the insects. I haven't yet found out what they eat. I am to try to bring you home a live family. If I can get safely to a British port I will immediately post them to you, and perhaps if they were put in an incubator at about 80° they might live long enough for some one to study them fully. It is a different species from the Pará one, but the silk tunnels are exactly the same. I haven't seen any winged forms.

Aug. 12, 1918.—The other box contains a piece of sacking with typical Embiid silk galleries. There is also a small tube, with four of the Embiids. The species is much smaller than the Pará Rubber one. I hope to bring home some of them alive. So far no winged forms have appeared. I am not yet certain as to the nature of their food. Their galleries permeate the cotton-seed. I hope the specimen will not get rubbed more than can be helped. The specimen will give you an idea of what a Pará tree looks like when its bole for ten or fifteen feet up (and even well up the higher branches) is covered round and round with such a web. The Pará one's web is scarcely so dense, being as it were translucent, which gives the trees the "ghostly" appearance which I have already described. I do not think that I exaggerate when I say that there must be hundreds in a colony. In the cotton store hundreds of bags had splashes of white on them, and altogether there must have been thousands of the insects. The store had unfortunately to be emptied (the seed being distributed), but I've little doubt but that they will appear again next

season. The (Agege) Pará form I think certainly feeds on the dead outermost layer of the cortex. The frass is quite solid, in the form of round particles. The frass of the cotton species is very similar. I think there can be no doubt that the galleries are protective. As I told you, *Oecophylla* constantly run over the silk of the Pará form, making no attempt to penetrate it. They readily attack and kill individuals that one forces outside the web.

B. Termitidae.

1. *Three Genera of Termites from a small part of a single Carton Nest at Agege.*

[Material:—A tube containing Termite soldiers and workers in spirit, from a "fresh bit of carton nest not as large as a football"—the nest (formed in a stump), in the disused parts of which *Camponotus maculatus* had established itself, and *Catochrysops phasma* pupae were found at Agege, on Sept. 10, 1917 (p. 392). Mr. Hugh Scott kindly examined the specimens and recognised the existence of three species among the soldiers. He then submitted the material to Prof. F. Silvestri who determined the species as *Ancistrotermes crucifer* Sjöstedt; *Hamitermes evuncifer* Silvestri; *Pericapritermes urgens* Silvestri, var. *nigeriana* Silvestri. Workers as well as soldiers of each species were present. Prof. Silvestri wrote March 22, 1920: "It is possible that all the specimens were found under a decayed trunk or in an earth nest of Termites, but I can assure you that each species has its own galleries. We do not as yet know any species of Termite living in the same gallery with another species, but it is very common for two or more species to be found in the same nest, as described in my paper on West African Termites." ("Contribuzione alla conoscenza dei Termitidi dell' Africa occidentale," Boll. lab. zool. Portici, ix (1914), pp. 20, 73, 135.)]

Sept. 18, 1917.—I am curious to know what the Termite is that figures in my *Camponotus maculatus* Lycaenid find (p. 392). They are of no direct connection, but you will see when I send you a few that I put in spirit, that the "soldiers" [of *Pericapritermes*] are extraordinary looking individuals with particularly extraordinary mandibles exhibiting marked asymmetry. I have been puzzling over the value of such an odd departure but have had to give

it up. They had a curious habit too of jumping in a manner recalling some *Ponerinae*. Their jump only carried them half an inch to an inch away, but it was most characteristic and was not a feature of the workers. These latter too have normal symmetrical jaws. I could not detect any intermediate forms and the soldiers were curiously few in number and isolated. [Believing that only one species was present Farquharson assumed that the soldiers of the other two were workers.] Though I can send you no sexual forms, perhaps the species is well and easily recognised by its odd soldiers.

The species of Termite is one that fastens on to large bush stumps and gradually converts them into a carton and mud heap, mainly carton, unlike *T. bellicosus* our commonest form whose hill is entirely of clay.

2. *A Swarm of winged Termes bellicosus Smeathm.*

Sept. 18, 1917.—Termites are the same [as *Camponotus maculatus*, in the sexual forms being phototropic, the others lucifugous: pp. 424–25]. The flying stage of *T. bellicosus*, which I believe is our commonest one (it is preyed on by *Megaponera*), is a bigger nuisance than all others and is all the worse from being more frequent. Not long ago a swarm of these invaded my place. They soon drop their wings, and in that de-alate condition are much relished as an article of food (cooked) by the Yorubas. I find a hurricane lamp placed in a basin of water a useful trap. After dinner I went out to see the "catch," and found the night watchman (this was at Ibadan) eagerly sweeping up hundreds of them that had alighted round his lamp. He plunged handfuls of them into a bucket of water to keep them from wandering off, and appeared thoroughly well pleased over this manifestation of the bounty of Providence. A little native cat of mine was also very busy eating those that escaped the watchman. I watched "William," the cat, with amusement at first and then with closer interest as he started hopping round in evident trouble, something obviously having bitten him. A serious-looking and somewhat inflated frog (he also happily gorged) was also moving out of the way. I went down the verandah stairs to investigate, and found that the Termite winged forms were coming from numerous innocent-looking small holes in my quite level compound. There was no hill, and their presence there was a great surprise to me. But the source of "William's" trouble and of

the frog's caution was soon evident. The watchman also suddenly became acutely conscious of it. The surface of the ground was swarming with soldier Termites, and a *bellicosus* soldier gives a rather severe bite. After a time the swarming ended and the soldiers disappeared underground again.

C. Psocidae.

Psocus nigeriensis Newst., sp. n. (p. 452) *and two other species on "Ant-trees" at Agege.*

[Material:—Eight *P. nigeriensis*, labelled "Common on Pará-tree bark (gregarious), Pará Rubber plantation, Agege, Sept. 22, 1917."]

Agege.

Oct. 18, 1917.—During September there were to be seen on the Pará trees colonies of curious little creatures that appear to me to be related to *Psyllidae* or some nearly related group. At first they are wingless and sit and feed crowded together in a circular mass about the size of a crown piece or even larger, apparently in defiance of *Occophylla*. They retain the gregarious habit till they become winged, after which I think they must separate. The imago after the last change is at first whitish in colour. In the mass they are by no means conspicuous. Just to-day I came across yet another curious colony, very like young Psyllids but protected by a thin silky web. I hope to get a few mature forms with good luck. Under the web are enormous numbers of eggs, of oval shape. I sent you one or two of the first group and will send more later.

Moor Plantation.

Feb. 4, 1918.—I am sorry that they were in such bad condition, for they are the most dreadful beasts to put up that I've yet tried. That was why I put some in spirit—immature forms—though I had another reason too, of which I'll tell you. I wished to let you see that they *had* abdomens, for they shrink terribly in drying. When alive they are miserably soft and delicate creatures, the slightest pressure causing them to burst. They are likewise very difficult to catch, not because they take alarm and fly: they don't, but they refuse to leave the bark of the tree. The net cannot be used, and when one puts

a tube over them they simply sit still or at least won't go up the tube. I may say that I know of three species! All so far I have found on "ant-trees," but I've had two horrible misfortunes in losing two sets of the others, but it is only a matter of time before I get them again. My chief reason for sending the spirit ones was because I saw no evidence of the adults feeding, while the immature forms appear to *eat* bark! I intended to look for a biting apparatus, but had to send home the material before I got time; but what I took to be their frass appeared to be solid. Let me say definitely that the ants do *not* attend them, they ignore them, though why they should tolerate such soft-bodied, harmless things I don't know. The Pará species is left alone by *Oecophylla*. The other two species were on *Cremastogaster* trees, *Antiaris* and an Anonaceous tree, the latter a beautiful form with almost black wings. It seems almost incredible that such large insects could have been overlooked. They feed in a colony and remain together till the last, when they disappear. Males I think are very rare, if the males are one or two relatively tiny forms that I've seen amongst the crowd of large ones. I am sure they are not sucking insects. I should say a colony might number a hundred or two. They generally congregate in a circular crowd. I think I know their eggs, which are like little rafts of mosquito eggs, very similar indeed, but I was waiting a chance to see them emerge before making any announcement. I am looking forward to hearing more of them. I'll try sending the next I get in wool like mosquitoes. I am in hopes that I may get some more when I run down to Agege to pay my labourers there. The black-winged species I found here, but they aren't "on" just now. But it's only a matter of time—and good health. There's another quaint group of Psyllid-looking creatures that spin a protective silky web. They also are "corticolous," but are very much smaller. I'll get some of them too.

Feb. 12, 1918.—[Speaking of his first doubtful belief that the insects were allied to *Psyllidae*.] You will gather from my last letter that I *had* doubts, lots of them, but somehow I never thought of looking in Sharp, Pt. I, for them. What upset me was the "frass," which led me to believe them to be mandibulate insects, at least before the imaginal stage (for I have never seen them feed then). I vaguely wondered whether suctorial insects like Psyllids

might not have evolved through such forms, and of course didn't take the time I ought to have taken over them. It is a dreadful lesson and I feel so *intensely* annoyed about it. The only Psocids I've ever seen—and I grieve to say I took little note of them—were under cover-glasses in Canada balsam—microscopic things. I *will* try to get more and work out the life-history.

Feb. 14, 1918.—It is remarkable that such wretched soft-bodied animals can live on the same trees as *Oecophylla* with no protection at all in the way of silk.

III. HYMENOPTERA.

[Between 1913 and 1915 Farquharson made many valuable observations on the life-histories and habits of Aculeate Hymenoptera at Moor Plantation: but this work, with the exception of the following, was undertaken under the direct influence of his friend Lamborn, and its publication is better deferred until their joint labours can be communicated to the Society. It would not be right to include one share without the other, and Lamborn's is too extensive for incorporation in the present memoir.]

A. Heterogyna.

1. *Notes on Paltothyreus tarsatus F. and Megaponera foetens F.*

[See also Farquharson's earlier notes on these ants in Proc. Ent. Soc. Lond., 1915, pp. v, lvi–lix.]

May 28, 1915.—You will have begun to wonder whether I am ever to send you any insects at all. It is not that I have not tried to get something done, but up till now I have had very little success, partly from mistakes in technique, partly from ill-luck, but in the main from lack of time. My chief bit of ill-luck was with *Paltothyreus*. One morning after a tornado I noticed a large winged ant apparently looking for a nesting-place. I put her into a tin and got her up to the laboratory; I got ready a glass jar with some sand and small stones and cautiously opened the lid of the tin. She had dropped her wings, which I have kept. I put her into the jar and in no time she started to dig herself in. I put live earthworms into the jar, but these also dug themselves in, and as far as I could see, she made no attempt to attack them; in fact, for her

large size and formidable appearance, she proved extremely timid. She retreated before live house-flies even. I then killed food for her and put it at the mouth of her burrow. Whether it was dead worms, flies, or Termite soldiers, all disappeared. She distributed them at different levels, and in a few days' time I was able to see a few eggs. These had developed into fair-sized larvae in one or two cases, when something went wrong. Minute mites and equally minute flies attacked the food-supply, and for some time I have seen no other signs of life. Fresh food no longer disappears, but I have not yet opened the nest.

[The following note refers to Proc. Ent. Soc. Lond., 1915, pp. lvi–lxi.]

July 26, 1915.—I was greatly interested in the additional notes from Dr. Arnold's work on *Megaponera* and *Paltothyreus* [in Ann. S. Afr. Mus., vol. xiv, 1915, p. 1], and more than ever wished that Lamborn had been here. We would have gone to every corner of the station where *Paltothyreus* was to be found to check his (and my) observations. Unfortunately I do not know of *Megaponera* here [at Moor Plantation]. Arnold's observations are rather at variance with mine, and I am most curious to know whether Neave and Stigand support either of us, or whether on the East side still other variations in their behaviour occur. I am writing Lamborn about *Paltothyreus*, for he must have been very familiar with their habits. I must say I have never actually heard the stridulation of *Paltothyreus*. It cannot be so marked as that of *Megaponera*, or if so it must very seldom occur here that they stridulate at all. When I made my serious observations on *Megaponera* (I had previously observed them casually, giving them a wide berth, and put them down as *Paltothyreus*), acting on Lamborn's hint, I was most careful to describe only what I saw, for he had never seen *Paltothyreus* on the march. I doubt if he remembers the incident, for he probably thought I had made a mistake and hadn't given the matter a second thought. I felt, however, that it was up to me to substantiate my story. Merely to stamp on the ground in their neighbourhood is enough to produce the disgusting smell which is so characteristic of *tarsatus*. When I met the big ants on trek this was the first thing I did. The result was the loud hissing and no smell. To make absolutely certain I trod lightly on one or two so as to injure but not kill them,

for I had no forceps with which to hold an undamaged one, and I thought from the look of them that a forceps would be indispensable. I then got hold of the damaged ones in my fingers and smelt them at close quarters but could detect no smell, nor could my friend, the late Mr. Owen, whom I asked to confirm it.

I cannot quite understand the "great disparity in size between the two forms composing the colony," which has a "very singular appearance." The specimens which I brought home were typical and so far as I remember do not show a very singular disparity. I did not see the males and females. I had a winged form, or thought I had, of the species, but it got lost. It had emerged I think prematurely. I may have the good fortune of course to see them again, and even to see the actual raiding of a Termitary. By the way, is the prey of the Matabele ant the same species as that of the Nigerian *Megaponera*, because if so the three or four victims that each "usually" carries surely cannot be soldiers? In nearly every case my specimens carried soldiers, and some of the individual soldiers were larger than the ant.

I thought at the time that to carry one and maintain its place in the ranks was no small feat on the part of a single *Megaponera*. I should think they specialise in Termites. *Paltothyreus* does not. I mentioned that earthworms are a common prey, though when a Termitary is broken open they are soon in evidence. My female, *P. tarsatus*, which by the way was ruined by mould or some other agency (I have only the cast wings left), was, considering her size, very timid, and retreated before a soldier Termite, so that I supplied them to her dead lest she herself should be destroyed. These she always carried down the burrow. A wretched big Sarcophagid fly accounted for her larvae, I think. I cannot say I have ever seen them even in a small file, but their nest or colony has numerous small exits with earth borings round each mouth or opening, and they keep constantly foraging round the immediate neighbourhood, each independent of the other.

Arnold really had astonishing good luck to see their migration to a new nest and their queen too. Still I may manage to complete the account of the Nigerian ones. I think it would be well to get a few notes from Lamborn on *Paltothyreus*, especially in regard to the stridulation. It is possible we are all right, but I am glad that Lamborn's

innocent challenge led me to take greater care than I might have done.

Sept. 28, 1915.—In the Shagamu district down to Ikorodu (W. of Epe and Oni) I saw lots of the Matabele ants [*Megaponera*], always with the same prey. They are very abundant round there and are called by the natives (Yorubas) "Jamjogu" (syllables all of equal length), which signifies "fighting" or "warlike." I had no opportunity of getting at their nests. I got a few more specimens.

2. *Notes on Camponotus maculatus F., var. melanocnemis Santschi.*

[Material:—A long series of ☿☿, varying, although not greatly, in size, taken May 25, 1915, from a nest in an old Termitarium in the decayed base of a large tree. It is probable, although not certain, that the tree was the one referred to below as cut down on May 28. For the relation of this form to Lycaenidae see the notes on *Catochrysops phasma* (p. 392) and on *Lachnocnema bibulus* (p. 388). The ☿ ant attending a pupa of this last Lycaenid came from the same nest as the above-mentioned series.]

May 28, 1915.—We have been having rather heavy rains to date. My last piece of entomological news relates to ants again. To-day a large tree was felled here, and in the decayed base of it was a nest of what I take to be *Camponotus maculatus*, var. *melanocnemis*. I failed to find the queen, but I got larvae in all stages as well as pupae, the latter being in pale flesh-coloured cocoons of very thin texture. I will send you, this mail, specimens of larvae and cocoons as well as soldiers and workers. What puzzles me is, that last year we had an extraordinary flight of winged forms which Dr. Lamborn took to be of this variety. They were very large insects. A few winged forms came from prematurely ruptured cocoons to-day and they are quite small. However, I have secured a large number of pupae, larvae and adult forms, which I have put into a box with wood from the same tree—in fact, the portion where the nest was, which had been previously tunnelled by Termites—and they appear quite at home. All the pupae and larvae are stowed away out of sight, and the adults are now gorging themselves with sugar at eleven-and-six per stone. They ought to do well.

March 1, 1917.—When I went down the other night well after dark to look for evidence of night-feeding [by *Tera-*

toncura imagines, p. 349], I went to the *Cremastogaster-Argiolaus* tree and was surprised to find the large *Camponotus maculatus*, ? var. *melanocnemis* running all over the tree. I remember cutting into a bit of the decayed heart last tour and causing a hurried sortie on their part, but I had forgotten that they lived inside the decayed heart. They appear to be night-hawkers. It is rather extraordinary considering their great size and heavy armament in the way of jaws. But, although *Cremastogaster* never seem to stop, I visit that tree every day and never see one *Camponotus*; yet that night they were all over it. Yet the nuptial flight finds the fliers in a markedly phototropic mood, and they are a dreadful nuisance now and again in the house. The flying stage is such a large insect. They always come about dinner-time, 8 p.m., and I have to shut doors and windows at the risk of suffocation. One can actually hear the patter of them at the lighted window, reminding one of a shower of hail at home.

Sept. 16, 1917.—*Camponotus maculatus* is a nocturnal ant. One occasionally sees workers in the open on plants in the daytime, but very seldom are soldiers to be seen. I know of a nest at Ibadan in an old tree from which I can make a few outraged soldiers emerge at will by thrusting a little twig into the opening—a sort of friendly call to make sure that my friends are still to the fore. But at night the whole neighbourhood of that tree is alive with them, soldiers and workers too. In spite of their great size and heavy armament, these soldiers are singularly timid. They cover the retreat rather than pursue aggressive tactics. A Driver soldier will bite at one's bootlace or puttee in impotent fury, and even the relatively tiny soldiers of a *Cremastogaster* colony make for the enemy at sight. *Odontomachus* hasn't got such a name for nothing. He lives up to it. As for *Oecophylla*, at the first alarm the whole crowd come out on to the surface of the nest ready for action, all facing the enemy. I have often amused myself "drilling" them by moving a little twig from side to side just an inch or two (or even at considerably longer distances) in front of them, moving it like a precentor his baton. At each change of position their heads and bristling antennae are turned simultaneously. One can do the same with a Mantis, but he somehow is a comical spectacle as he orients his head; *Oecophylla* inspires respect, and so does *Megaponera*. There are two or three nests of them

here now, and I really do think it is a horrid libel to apply the adjective "foetens" to them. By-the-way, did I tell you that Mr. N. H. Thompson, the Chief Conservator of Forests, agrees with me that they do not "stink away the enemy"? I think I came on that phrase somewhere in Sharp the other day. If man be the enemy, how true that is of *Paltothyreus*! An alarmed colony of *Camponotus maculatus* forthwith sets up a great tapping, which is most distinctly audible on the hard stem of a tree.

Sept. 18, 1917.—About *Camponotus* one other note. Lizards are extremely fond of them, the workers at least. Daytime stragglers are eagerly snapped up. A tiny *Agama*, running about near the door of my bush hut here, came and carried away some of those from my carton material which had escaped from the box.

Is it not odd that the asexual stages should be so markedly lucifugous while the sexual individuals are as markedly phototropic? Earlier this tour, I think about March, I was at a place called Oyo (Awyaw) about 30 miles N.W. of Ibadan. Just as it was getting dark one evening I saw the beginning of a nuptial flight of *Camponotus maculatus*. They also were issuing from a small hole in the ground. (If I get back to Oyo at all I'll seek out that place again, for other [Lycaenid] reasons!) As in the case of the Termites the soldiers also came out in force, covering the ground for some distance round the various craters, for the nest had multiple openings. The winged forms didn't start off immediately on emergence, but many went back into the nest, though it was impossible to tell whether or not they came out again.

3. *Artificial Ants' Nests: Inquiline Mites.*

July 26, 1915.—I have tried my hand at an ants' nest, but we have very little plaster of Paris here, and what there is has gone off a bit and my first nest hasn't set. I'll describe it later, but meantime it contains a fine little family of what I take to be a Camponotine which I got from a newly felled palm. They are small ants about the size of our house Pheidoles, black, and run about with extraordinary rapidity. I secured two apparent females and one or two workers with a lot of cocoons, for the pupae are in little white cocoons. I am greatly afraid of mould, but am to try another form of nest. Meantime they are doing well and like brown sugar. What is more, they are parasitised in several cases by a sort of preserved-strawberry

red mite. One or two have two or three or four mites, and I think, so far as I have observed, the mites take up a symmetrical position on the pedicel. There is a much larger fat-looking mite moving about among the débris, which I'd like to prove was the female parent. With a little luck, however, I may make something of this lot. I have also another family, with naked pupae, of an extremely minute red ant, hardly over half as big as a *Monomorium*.

Aug. 11, 1918.—[Probably referring to the above nests.] Another thing I was keen on working up was the mite inquilines on one of the Pheidoles here, not the house one. I found them duly arranged as described in Wheeler, on the callows of the species, but my nests were destroyed by *Monomorium* and I never got the chance to set up new ones.

B. Fossores.

Ammophila lugubris Gerst. (*beniniensis Beauv.*), *its Prey and its Enemies.*

[Material :—*Ammophila lugubris* (Proc. Ent. Soc., 1918, p. cxxxvi)—1 ♀ labelled "No. 2.—30.v.1915," accompanied by the relatively large stone plug of its burrow and one of the Tachinid flies bred from its prey. The fly, which is labelled "Tachinid fly, emerged 20.vi.15," is the type of a new species described by Dr. Villeneuve on p. 518 as *Hilarella helva*.]

May 31, 1915.—Yesterday I saw a most interesting sight. A wasp, I think an *Ammophila*, was dragging a Noctuid larva along the ground, with a view to burying it, and I stopped to watch her. Closely following her was a Chrysid. The wasp selected a place for a burrow and started digging, the Chrysid sitting close at hand. This wasp digs a very shallow nest and soon proceeded to stow away the prey on which she oviposited, as I afterwards found. Instead of filling the nest with the excavated earth she came back with a small stone and was just about to place it when a small fly, most probably a Tachinid, for it happened so quickly that it was all over before I had time to attempt to catch it, swooped down and appeared to drop her egg or eggs on to the tail of the larva which was just visible. The wasp simply placed the small stone and went off to get another. As she was placing this I captured her. The Chrysid I lost. I dug out the larva and saw the wasp egg, but at the time saw no sign of the Tachinid egg. I did not do a careful examination, for

I didn't wish to expose what I had got to the sun. I thought the fly ova had been lost in the soil. The wasp egg was placed about the middle of the host body and was quite conspicuous. It could not have been seen without digging out the larva. Yet shortly after, when I reached my quarters, I observed signs of life beside the wasp egg. Four or five minute maggots were "crowding" round it. To-day the wasp egg has disappeared, as far as I can see, and the maggots appear to be trying to enter the larva. Now, unfortunately, there is a doubt as to the fate of the wasp egg. I think the maggots accounted for it. But the moth larva though unable to crawl is capable of a very strong reflex, and, as the maggots try to penetrate it, it jerks with vigour, and I have not been able to confine its movements as they would be in a cell in the ground, and the egg may have been damaged in this way. On the whole, however, I think not, for the larva was unable to roll over so that the egg would be underneath, and the egg could not come into contact with anything above. It was interesting to note that the larva, though it couldn't crawl away, could yet function in another way and excreted about fourteen faecal pellets. This would, I take it, materially assist its parasites by checking decomposition. I shall try to rear the flies, and if I succeed will be sure to send them on. I'll know by next mail, I think.

July 3, 1915.—[Referring to the material despatched.] No. 2 is the wasp of which I told you. Her prey had 4 or 5 viviparous Tachinid larvae dropped on to it as she was just about to close the nest. I failed to get the parent Tachinid which worked with such extraordinary suddenness and rapidity. None of the other flies have emerged, though I can see the pupae more or less distinctly.

[Comparing this statement with that of May 31, it must be regarded as uncertain whether the Tachinid larvae were deposited as such or emerged from quickly hatching eggs.]

C. Diploptera.

Odynerus lateralis F., building its Nest in a Teapot.

April 24, 1918.—I've just noticed a most extraordinary and very funny thing. I've a strong weakness for tea. It is the finest restorer in the world (closely followed by a bath) and, even in this rather hard-living part, most men confess that they'd miss any "meal" of the day rather than tea, so I keep a reserve of teapots. Hearing a buzzing

noise over by the sideboard I saw a *Rhynchium* [*Odynerus*] *laterale* in the very act of going down the spout of one of the "reserve" pots. I have just discovered that the inner holes at the bottom of the spout, are "built up" with mud and the mouth of the spout in process of being also built up. It is my "going away" pot. I must remember to warn the boy next time I travel to Agege. These wasps are the most persistent animals. *Vespem "furca"* (any convenient missile or newspaper) *expellas, tamen usque recurret.*

IV. COLEOPTERA.

1. *Colour Associations of S. Nigerian Mylabrid Beetles.*

[The first three paragraphs refer to the species of an Ibadan colour-association, described in Proc. Ent. Soc. Lond., 1916, pp. xcix–cx, pl. B.]

May 3, 1917.—The suggestion that it was the sterile flowers that were eaten is correct [Proc. Ent. Soc., Lond. 1916, p. ciii]. I may say that just lately I have seen one or two forms on the flowers of native Convolvulaceae, which are abundant here and elsewhere in the Colony.

Lamborn suggests that the larvae may feed on the ova of the Acridian *Zonocerus variegata*, but before I'd got his letter these had disappeared for the season, but I will bear it in mind.

Dec. 12, 1917.—Do you know, a few months ago I had to go about the day after I had seen two *Decatoma affinis* Ol. (type) ovipositing! I had perforce to go away and leave them. I saw the ♀s digging holes in the ground like Fossorial wasps. One oviposited about 6 or 8 inches down, a mass of yellow sticky eggs. [A. Loveridge describes, in Proc. Ent. Soc., 1921, p. xc, the large *Mylabris oculata* Thunb., var. *tricolor* Gerst. ovipositing in a hole about 1 in. deep.] I had hoped to follow up a tip from Lamborn to look for them in contact with Acridian ova, but they were in contact with nothing that I could find. The other ♀ was just starting to excavate. That is only one of many disappointments.

[The remainder of this section describes a somewhat different Mylabrid association from another locality. The material is tabulated in detail on p. 432. The species were kindly determined by Mr. K. G. Blair with the able assistance of Mr. H. Britten in the preparation and examination of male genitalia.]

Agege.

Oct. 17, 1917.—I am only here for a day or two waiting for a boat from Lagos to Port Harcourt, from which I go up the new line for a bit and then strike east to Okigwi.

Port Harcourt.

Nov. 15, 1917.—I believe I have found still another facies of the *Decatoma-Coryna-Mylabris* complex. I won't be able to send them from here as they are not dry yet, but I will I hope manage them for the next. I'm afraid they will be all I'll be able to send for my Xmas gift, but I couldn't get a chance to do better. For most of the time I was travelling in country that is rather unsettled, besides being entomologically and mycologically rather arid—grass country. The treks were long and I had to keep in touch with unwilling carriers who were, not without reason, afraid to go twenty miles from their own village to the next rest camp. At this time of the year in these parts and over to the Cross River (that is in the Udi and Okigwi districts, east of the Niger, north of here about 100 to 150 miles) there is a notable head-hunting ju-ju in vogue. I believe the hands of the village belles are only given to youths who have sufficient enterprise to secure the head of some other tribesman. The limits to which "auri sacra fames" will push a mortal man are nothing to what Eros can do in these parts. The victims do not get a clean, straightforward death (nor even a quick stab in the back). They are subjected, I believe, to not a little ceremonial torture of a very dreadful kind. It is odd to think of this happening within ten miles of a railway. But I am getting away from my subject. I have got forms like some of those at Ibadan (*Decatoma*, I think), but others with the yellow bars on each elytron reduced to two yellow dots, the antennae black with a red tip, otherwise very closely resembling the Ibadan forms. I have got one or two others of other kinds, but unfortunately none *in coitû* and not a great series, for I simply had to snatch at them as I went along wherever their food-plant, a Convolvulus, occurred. As far as possible, too, one gets as much of one's trek in before the sun gets too hot, and, in early morning, say up to 8 or 9 o'clock from 5 a.m., they are hard to find. They rather like the sun and were not to be found in the heavily shaded palm groves. But they may prove to be of interest, and some day I may get a better chance to add to them.

I must now catch the mail. Port Harcourt you may not be able to find on the map, but it is located on a creek that enters the sea at Bonny, and is, I suppose, about 40 miles north of that place. It is one of the most important places in Nigeria, being the terminus of the new Eastern Railway which runs up to the Udi coalfield. An account of the latter you will find, I think, in a fairly recent issue (not more than 12 months old, I think) of the "Bulletin of the Imperial Institute." Part of its way, the railway taps districts enormously rich in oil-palms. Quite large cargo steamers (up to 7000 tons, at any rate) can come up here. Within a stone's throw of where I am now two considerable vessels are loading up coal and oil. Nigeria is undoubtedly a great imperial asset, and yet one meets people at home who have the vaguest notion of where it is on the map, or who think it is a part of Sierra Leone, a place called the White Man's Grave. I have even seen a review of our Department's annual report in an important paper, headed "Agriculture on the Gold Coast" !! I wonder if the Germans were as hazy about the Cameroons. I hope I may be able to make a little of it known to naturalists if only I could get a little more leisure.

Moor Plantation.

Dec. 9, 1917.—One of the boxes (for I sent two) contains the first batch of the new *Decatoma* facies of which I wrote you at Port Harcourt. I had to pack the specimens hastily on a false rumour of the mail going, but I hope enough will reach you intact for diagnostic purposes. I have kept some in reserve, but some of the larger forms I cannot replace. There are two which differ from all the others and from each other [*Mylabris afzelii* Bilb.]. They are the only ones I could get. I will first tell you where to find the places on the map. If you can find Onitsha on the Niger, well up towards the boundary between N. and S. Nigeria, the rest will be easy. Due east from Onitsha (22 miles by road) is the town of Awka. Still going eastward and a very little north you will find Udi, which is rather over 30 miles from Awka. Udi Government station is about 1200 to 1500 feet above sea-level. You will see that the road from Awka crosses a range of hills at Udi—the range running due N. and S. About 11 miles east of Udi is the new Nigerian Eastern Railway, not shown even on fairly recent maps. If you follow the ridge of hills northwards, about 12 to 15 miles, perhaps, direct and a little to the east, you will see a place called Enugu Ngwo.

That is where the great coalfield now being worked by the Government is located. The railway runs from Port Harcourt to Enugu, the present rail-head. Port Harcourt is at the head of the Bonny River and is practically the same as Okrika, which you will see on the old maps. I went to Enugu by rail, then took the road to Awka, which meets the Udi-Awka road at Oji River crossing. This involves a 26-mile trek in one day. The next day's trek took me to Awka, where I remained a day or two and was then hastily recalled back here to take over from the Director of Agriculture, who is going home by this mail. I returned to rail-head by a route which took me through Oji River and Udi. For the most part the whole area is grass country, except in valleys which carry heavier vegetation, or would if they weren't largely farmed. Palms (oil), however, are abundant and indicate the more fertile valley conditions. The "Decatomas" were not found in the more heavily shaded places, nor yet in the drier almost pure grass lands, but rather in the intermediate country. Owing to a faulty bicycle and the necessity to keep up with my carriers I could only—almost literally—grab at specimens as I passed along; wherever I saw the Convolvulus, which is their favourite food, I would stop for a minute or two and then hurry on, not favourable conditions for intensive work, but perhaps favourable for the discovery of the dominant types. I had certainly no time to select. Unfortunately I could not obtain a single pair; never saw any. On the day when I found the two unique specimens [*M. afzelii*] or rather the forenoon of that day, I found very few of any kind. The morning had been wet, and the species are distinctly sun-loving. The few I found were hiding under leaves. It may, of course, be that they knew the uselessness of looking for open flowers in the rain. Dull weather markedly retards the flowering of many plants (*e. g.* cotton). Such Convolvulus flowers as do open—they are campanulate in shape—fill up with water, swamping the ovary and anthers, the food of the beetles. The corolla is also eaten. In the circumstances I would not venture to say what environment conditions the dominance of any type. I would almost hazard a guess that altitude has not a little to do with it, but I had to give nearly all my time to the subject of coconut disease, which was the reason for my being there at all.

Jan. 12, 1918.—This letter is simply an appendix to the last one. I just heard to-day that a supplementary mail was going, presumably by some intermediate cargo boat.

Perhaps the next direct mail will get there before it. I haven't time to put up a box, but I wouldn't have risked it anyhow. I am glad to say that I had no mails on the "Apapa," that I know of at least, and I believe my last parcel has got safely home. Two or three of the Decatomas were unique and I haven't got duplicates to send.

I got the papers from the Entomological Society, and have to thank you so much for getting me elected to its fellowship.

March 2, 1918.—The "Appám" (now called the "Mandingo") took home the Decatomas. I hope these will get as good luck. I only wish I had more to send.

April 28, 1918.—The Decatomas apparently complicate the original complex. I wish I could have got pairs, but it was impossible. The Ibadan ones are now beginning to appear, and I hope to make a collection of pairs this season.

[The Mylabrid beetles, belonging to five species, are tabulated below according to locality and also the order of time. Precise dates are not available.

Captured (mostly in Convolvulus flowers in strong sun), Nov. 1–15, 1917, in the order of time I–IV).	*Coryna chevrolati* Beauv.	*Coryna hermanniae* F.	*Mylabris tibialis* Mars.	*Mylabris vestita* Reiche, or close to it.	*Mylabris afzelii* Bilb. (nec Mars.), var. V.
I. Road from Enugu Ngwo to Oji River crossing on Udi-Awka road.	19				
II. Road from Oji River crossing to Awka.		3	3	3 (2 melanic and 3rd darker than any in IV).	
III. Road from Awka to Udi.	43		1		1 (Anterior half of elytra orange, posterior black).
IV. Road from Udi to Enugu Ngwo.		1		9 (1 with trace only of anterior black bar).	1 (As above, but trace of posterior orange bar, stronger on L.).
Totals .	62	4	4	12	2

The general appearance of the Awka-Udi association, with the exception of the 9 *M. vestita* in IV., is much darker than the Ibadan series illustrated on Plate B of the 1916 Proceedings. The latter, in fact, gives an impression of orange insects with black bars, the former of black insects with narrow yellow or orange bars, which in *C. chevrolati* are broken up into spots. The two *M. afzelii* and two of the *M. vestita* in II., however, have lost the appearance of barred forms, the latter being melanic, with only faint traces of orange, the former orange anteriorly and black posteriorly, thus resembling, although much darker than, the vars. of *D. affinis*, *M. hermannioides* and *M. farquharsoni* in which the anterior black elytral band is wanting (Proceedings, 1916, pp. cvii–cix). The much blacker appearance of *afzelii* is due to the posterior orange bar being obsolete or absent. One of the 9 *vestita* in IV. resembles the Ibadan forms of the same variety.

Comparing the size of the beetles in the two localities, *M. afzelii* is much larger than any of the Ibadan series, *M. vestita* of about the same size, the other three species considerably smaller, this being true of the four examples of the only species common to the two—*C. hermanniae*, which is smaller as well as darker than the Ibadan average. It is probable that the Ibadan *hermanniae* has converged towards *D. affinis* and the dominant *M. farquharsoni*, the Awka-Udi *hermanniae* towards *M. tibialis* and the dominant *C. chevrolati*; but much larger numbers are required to test this conclusion thoroughly. Larger numbers are also required in order to determine the extent and the meaning of the difference indicated by a comparison between the three specimens of *M. vestita* from locality II. and the nine from IV.

The Mylabrid beetles here tabulated were accompanied by seven examples of a fine Homopteron, the Cercopid *Locris maculata* F. with the label "widespread in the Awka-Udi districts, also at Ibadan." Six of these are yellow, black-marked insects with considerable general resemblance to but less dark than the Mylabrid vars. which have lost the anterior black bar; the seventh is nearly melanic, the yellow being reduced to two narrow bands made up of small spots. This form resembles the two melanic *M. vestita*. A further collection with precise localities would be of much interest.—E.B.P.]

2. *Erotylid Beetles aestivating in the empty Clay Cells of an Aculeate Hymenopteron.*

[The observation on *Episcaphula interrupta* Lac. recorded in Proc. Ent. Soc. Lond., 1913, p. cxxii; 1914, p. xxiii, is so curious that further details are added from Farquharson's letter. The first and last sentences refer to a suggestion that, as *Erotylidae* are fungus feeders, the supposed cells might have been fungi.]

Feb. 10, 1914. – It sounds almost like libel to suggest that I confused clay cells with a fungus, which some one seems to think must have happened in connection with the discovery of the Erotylids. It is fortunate that Dr. Lamborn saw the actual cells. Perhaps the vagueness of my note misled them. I may briefly recount the circumstances. While examining a stump by the side of a small stream for Mycetozoa I came across two small cells of the "Potter" class. Frequently the bottom of these cells is not of clay but is simply the flat surface of the object (wall, log, etc.) on which the cells are built. Or the cells may only be partly "floored" with clay, as if the builder were simply adding a little for levelling purposes, so that on prising off a closed cell the larva or pupa may easily be seen. The first of the two cells that I prised off was of this order, and, as soon as it was detached, the beetles started to come out. I hastily put the lot, cell and all, into a closed box. A little wood from the stump came away with the other cell, and as the "lid" of the "pot" was stopped, loosely, I think, with débris and not with clay, and nothing tried to get out, I simply put it into my vasculum. In the evening, when we came to compare notes as usual, I handed the cells to Dr. Lamborn. On opening my vasculum I found that the Erotylids were just beginning to come out of the second cell. Of the composition of the cells there was no doubt. They were of clay. At the time, I think, we concluded that the beetles were aestivating. I think we dismissed the idea of their having been stored by a wasp, as they were extremely lively on issuing from the cells. I fear I can throw no further light on the matter, but I think that if the B. M. authorities make such dreadful suggestions I shall seriously consider the question of sending any more Myxos!

3. *Notes on the Life-history of the Endomychid Trycherus flavipes Arrow.*

[The species was described from Farquharson's bred specimens in Trans. Ent. Soc. Lond., 1920, pp. 10, 11. Material:—2 ♀, emerging Oct. 9, 1917; 2 ♂ 2 ♀, Oct. 17 (1 ♂ 1 ♀ with precise pupa-cases); 2 larvae in spirit. All

from Agege. A ♂ (the type) and 2 ♀ are in the British Museum.]

Agege.

Oct. 18, 1917.—On the same Agege *Hewitsonia-Argiolaus* tree [*Antiaris africana*] I found some curious little spiny Coleopterous larvae that the ants seemed to leave alone. These run about freely, and not really very rapidly, apparently being able to take their own time, regardless of the ants. They pupate on the bark, in tiny pits or crevices. In one case I got two just beside a *Hewitsonia* pupa. Till yesterday I only had two pupae. These I got before going to Ibadan at the beginning of this month and they bred out there. I sent one as they were scarce, but now I shall have half a dozen at least, I think. I have decided that they are Endomychidae. One emerged yesterday evening about 8.30, and this morning there were two in addition. When newly emerged (the first one) it was whitish in colour and the wings were for some time kept unfolded and projecting beyond the elytra.* It seemed to me to be an amazingly large animal to have come out of such a tiny pupa-case. The Endomychid larva (if I have correctly classified it) appeared to feed just as the Hewitsonias.

Moor Plantation.

April 17, 1918.—I am so glad that the Endomychid was workable after all. [Mr. Arrow considered that the colour of the first specimen shown him had not quite matured.] They must take a good time to harden, for I left them, in one or two cases, at least 24 hours before killing. However, I'll probably get better material this year again.

Aug. 11, 1918.—By the way, I found the Endomychid larvae on the *Cecidomyia* tree [p. 442] to-day and have got one pupa. I am sure it is the same one as I get at Agege. [Young larvae were again seen on the "ant-tree" on Aug. 25.]

4. *Dermestes Larvae and Mites in Cremastogaster Ants' débris at base of "Ant-tree."*

Aug. 25, 1918.—While I was stooping down for a tin I noticed one other thing. At the bottom of the tree is the

* The following note was written Oct. 18, 1917, at Agege: "Just lately I have been breeding out a Coccinellid that feeds on *Aspidiotus destructor*, the pest I am going to Okigwi to investigate. They do not appear to expose the wings after pupation [like the above Endomychid] but sit as still as a Coccid and looking like one."

ants' "kitchen midden," full of the usual débris, chitinous rings of all sorts of dead insects and goodness knows what else. I noticed the surface "heaving" and proceeded to investigate. I expected Dipterous larvae like those I got on the refuse heaps of *Paltothyreus* at Agege [see pp. 519–20], but instead I found brownish rather maggot-shaped larvae with rings of brown bristles, but whose head end was the broad end, the posterior end tapering to a point with long golden bristles. I could see no head (as they shammed dead, I at first thought they were Dipterous pupae), and indeed so far I have not examined them closely. But they have thoracic legs and run about quite actively after their initial "sham." Their shape is very *Lepisma*-like without the "tails," and I think they are Coleopterous. I am hoping they are nearly full-grown. I am to leave them with Dr. Connal on the off chance that they may breed out, and will take a few larvae with me. I could easily have obtained dozens of them. Incidentally the "refuse" was simply crawling with mites, and when I opened the tin this evening to see how things were doing, I was astonished to see that these had all congregated to one spot on a round piece of débris which looked like a round reddish-brown ball, so numerous were the mites. The lamp-light made them scatter and bury themselves at once.

5. *The Life-history of a Drilid Beetle, probably Selasia unicolor Guér., bred from Snails.*

[Material :—In spirit, a large apterous ♀ probably of *S. unicolor* and a bristly larva similar to the one from which it developed. These larvae are well known in African collections and have long been suspected to be the immature stage of the Drilid, *S. unicolor*. Farquharson's notes make this conclusion highly probable, but it is to be hoped that male larvae will be found and bred.

Mr. K. G. Blair writes : "The *Selasia* ♂ is a VERY much smaller insect than the ♀ in question, and must come from a very much smaller larva. This disparity of size is really not contradictory to the specific identity of the two insects, as in our *Drilus flavescens* the disparity is almost as great. The larvae of the two sexes are also very different in size, and, like the *Selasia*, feed on snails, hibernating and pupating in empty shells of their victims, but they do not appear to bury them as does the *Selasia*.

"We have a note by Dr. F. Creighton Wellman attached to one of these larvae from Angola :—

" ' The natives state that if you step on it with bare feet the bristles pierce the skin of the sole and work into the flesh, causing inflammation and even gangrene. Native name " *O-cisia* " (= noli me tangere). I have seen a whole caravan of porters warning each other in this fashion when an O-cisia was in the path : " Step to the side ! There is an O-cisia ! " ' "]

May 28, 1915.—Last year Dr. Lamborn bred from a large snail which flourishes out here a number of beetles—*Drilidae*, I think. I never saw them. It was before I came back from leave. One day a week or two ago I saw a curious-looking larva—I had seen them before without understanding their significance—quite near to a snail shell. I had been in hopes that I might one day see Lamborn's beetles in operation. I am not sure whether he saw what I am going to describe, but if it is old news it will at least be independent corroboration. The larva is a rather flat active creature, which I will describe when I send you a specimen. I sat down to watch its movements. It ran round the snail once or twice and then crawled on to the top of the shell. It then appeared as if it were about to crawl off again, but its posterior end remained attached to the shell while the head and legs were on the ground. To my surprise it proceeded to push the snail backwards by extending its own body, in a manner recalling the Scarabs, except that the snail was shifted bodily and not rolled or trundled. I concluded that the victim was being carried off for burial, where the earth was soft, for all this took place on a hard path. I put both together into a tin with some earth, and reached the laboratory about an hour later. When I opened the tin I found the snail nearly buried by a process of undermining. I half-filled a larger box with sand, into which I turned the two and watched the process in comfort. When the undermining was in progress the unfortunate snail ventured out, but the enemy doubtless feeling the strain, for the sucker pseudopod never let go, turned round and drove the victim well home. In about an hour's time the two disappeared underground. Nothing has happened since. I have, however, secured three or four more larvae, which I supplied with snails. They, however, didn't bury them, but started their unpleasant work right away. I am in great hopes that I may get a few mature insects to send you.

July 26, 1915.—Now another note about my snail

parasite. This was the doubtful *pièce de résistance* of last mail. The bristly larvae after a time emerge from the empty snail shell, minus bristles of any sort. They are like a large rather soft-skinned larva [the apterous ♀], very bloated in appearance, with curious short antennae and a more curious appendage at the posterior end. One of them one day oviposited a mass of sticky yellow eggs and died. The eggs are sulphur yellow when fresh. They are undoubtedly eggs and the larva [♀]—a large thing over an inch in length and nearly half an inch broad—is absolutely apterous. But I've seen no males, and I think the oviposition may be parthenogenetic. I have them in a flower-pot covered over with mosquito gauze. The worst of it is they won't feed. Another has oviposited and died, and I have failed to get the eggs to develop, owing to mould or want of fertilisation. From the first box in which I had them it is possible that a smaller winged male might have escaped. It was not protected by gauze, and the wooden box warped. However, I am in hopes that I'll manage to complete the cycle. Material in the form of the bristly larva is plentiful.

I wonder if you could let me know what sort of a creature the Drilid *Selasia unicolor* is which Lamborn bred (by accident) from a large snail. It was before I met him last tour. I think if it had been this extraordinary apterous creature he would have told me of it. Only he told me so much that I may have forgotten.

[Lamborn bred a female Drilid, evidently the same form as Farquharson's, from a larva to which a snail was given, in mid-June, 1913. The larva-like female emerged July 31, and was determined as probably *S. unicolor* by Dr. Marshall, and the snails on which it feeds as *Limicolaria* sp.]

Nov. 24, 1915.—I got off a specimen of the snail-parasite, larva and mature ♀, with a few ova. The latter are sulphur-yellow when fresh.

[In later letters he spoke of his hope to breed the male beetle, and, on April 28, 1918, of noticing numbers of the larvae. The last reference, shortly before he sailed from Lagos, is as follows :—]

Aug. 11, 1918.—Looking back over the 22 months, it is very little that I have been able to do. I had hoped to clear up the *Decatoma* life-history, the snail-parasite, and I don't know how many other things, but at any rate I've got clues to work on, and, if I do not get the chance, perhaps somebody else will.

6. *A Carabid Larva attacking a Snail.*

[Dr. C. J. Gahan, who has examined this fine Carabid larva, informs me that it is impossible to determine its genus.]

May 28, 1918.—While at Agege last I noticed a fairly large snail climbing up the wall of an out-house. I was attracted by its apparently "frothing" or blowing bubbles as it climbed. It fell down, and looking at it I found that it was attacked by a very large Coleopterous larva which I have sent you—if it is a larva. It is a horrid-looking creature. I tried to feed it up or give it a chance to oviposit, but it died, so I "spirited" it away. I left the snail in the tin in case ova had been laid, and now find that a large Dipteron had been there. I do not think it can have become infected while I had it. But the pupae are there, and I may get them bred out.

7. *Procryptic Beetles, probably Passalidae.*

July 3, 1915.—In a dead palm which had just been felled I got three very odd-looking beetles. They are very flat and hard, which I imagine is a special adaptation to permit of them getting between the closely pressed leaf-bases of the palm, where they were found.

8. *Beetles accidentally introduced in C. O. Farquharson's Consignments.*

[The following beetles were found in the cotton-wool or among the "papers" in a package received in January 1918:—Cucujidae: 12 *Cathartus advena* Walt.; 2 *C. cassive* Reiche; 3 *Haemophloeus pusillus* Sch.; 1 *Silvanus surinamensis* L. Curculionidae: 1 *Calandra oryzae* L. Scolytidae: 1 *Taphrorychus bicolor* Hbst.

Loose in a box received in July 1918:—Ptinidae: 1 *Lasioderma sericorne* F.

Loose in a box containing a pupa of *Teratoneura*, parasitised by small Chalcids (p. 459), received in 1917:—Corylophidae: 2 *Sericoderus lateralis* Gyll.

The species were kindly determined by Mr. G. J. Arrow.]

V. DIPTERA.

A. The Habits of two new Myrmecophilous Cecidomyidae.

1. *Farquharsonia rostrata Collin, gen. et sp. n.* (p. 505).

[The material includes 6 ♀, captured April 13–15, 1918,

at Agege (152 ft.), 16 miles N. of Lagos, together with 2 ☿ maj. and 21 ☿ min. of *Cremastogaster buchneri*, r. *alligatrix* from the carton nest over which the Cecidomyids were flying. Also, from Moor Plantation, stealing from ants on carton nests—2 ♂ 3 ♀ taken Aug. 8, 1918; 7 ♂, together with a sample ☿ of the ants, near race *alligatrix*, taken Aug. 10; and 10 ♂ 8 ♀ taken about August in the same year.]

April 17, 1918.—Your letter of early March arrived safely, having been a month on the road, but we are always glad when the mail gets here at all. I have not been able to send anything for some time, for I have been very busy getting in the crops now that the rains have broken. However, I hope to get a small collection together soon. I think I shall manage to get you some more interesting Myrmecophilous Diptera. Last week-end I had to go to Agege on my monthly visit, and went as usual round the few *Cremastogaster* nests within reach. I got no Lycaenids, but I was able to study the doings of a number of yellowish-brown midge-like flies that kept constantly flying over the nest and indeed within the labyrinth of the carton. Observation as to their exact doings was extremely difficult from their colour and from the fact that they didn't alight at all but remained almost like Syrphids, though not for so long at a time. At other times they kept up a dancing flight till their immediate object made them at any time approach the nest. I was at last able to satisfy myself that the objects of their interest were ants that were in the act of feeding each other by the usual method of regurgitation. Seeing these on the surface of the carton or in a crevice of it, one of the tiny flies would immediately approach near enough for its head or proboscis to be in touch with the ants, and though, from the fact that they were rather shy and didn't actually come to rest, I could not actually succeed in seeing them appropriate a share of the food by sheer theft, yet I have not the slightest doubt but that they did. *Harpagomyia* doesn't alight on the carton, which is always much too lively, but hunts on the stem of the tree over the "run" of the ants. The food exchange is quite leisurely and friendly. I brought away a few of the flies with me and found them to be Nemocerous Diptera—apparently, and if Nemocerous Diptera, I regret to say that with much thought and misgiving I can find no family for them except Cecidomyidae,

but, mindful of former misfortunes, I do not venture to say more than that they are Diptera. The antennae appear to have twelve or thirteen segments, with whorls of bristles, and are divided up by beautiful areolate markings. The venation of the wings is extremely reduced. The proboscis is quite a huge and rather remarkable affair, but you'll see them for yourself when they come. I hope to send them next mail. I haven't exhausted the Myrmecophilous Diptera yet, and am keeping them back so that I may send others with them.

[Farquharson had hardly posted the above record when he heard that his friend Mrs. Connal considered that the Diptera were *Ceratopogon*, with biting mouth-parts. He wrote later, on the same day, in some depression at what he thought must have been his mistake, but recovered to some extent when he began to recall the observed facts.]

April 17, 1918.—I can see what insects *do*, and I'll tell you nothing but what I see. I am by no means sure that the biting mouth-parts are actually used for biting. I am almost certain that my interpretation of their movements is the correct one. There would be no object in specialising *in pairs of ants* in the act of inter-regurgitation. I have written to ask Mrs. Connal if she will describe it and if so to allow her diagnosis to be published with the rest. I will send specimens next mail. The hind-legs, by the way, are carried like those of Culicidae.

Aug. 11, 1918.—It cheered me very considerably to write Dr. Connal that the Diptera *may* after all be Cecidomyids. Poor man he wrote me at the time that he had been made the "object of unlimited scorn" from Mrs. Connal over the mis-diagnosis. I think I told you that I have found them here also [Aug. 8; see p. 440], and, after very carefully watching them, I feel certain that my original view of their activities holds. They hover, with midge-like flight, as close as possible to the ant-nest, frequently going right into the outer cavities of the carton, till they see a pair of ants in the act of inter-regurgitation. They then dart forward a little, their wings all the time being in rapid motion, till their heads appear to be in contact with the point of contact of the ants' heads. What exactly happens I cannot say for certain, for they are harder to observe than *Harpagomyia*. But I'm sure they don't even try to bite the ants, and I can hardly doubt but that their object is to steal the "droplet" that

one of the ants intends for the other. I am confident that I shall see this happen. It is only a question of waiting till I can see the flies side-on. At any rate I am certain that only pairs of ants at regurgitation interest them, and that they never tackle solitary ants like *Harpagomyia*. Nor indeed do they ever come to rest on the surface of the trees as the mosquitoes do. (The mosquitoes keep in motion when actually soliciting food, but when not begging they frequently settle down on the trunk of the ant-tree.) Their hind-legs are backwardly directed when in flight, not unlike mosquitoes' legs, but their flight is rapid and dancing. I have spent a good part of to-day at one of the ant-trees (an *Alstonia*) which I do not visit as often as the others, for it has not yielded Lycaenids like the others. It is in a shadier part than the others and somewhat inaccessible, but I have had a path cut to it. It is very rich in *Harpagomyia*, but extraordinarily so in the Cecidomyids.

Aug. 25, 1918.—I spent a good part of to-day at one of the ant-trees just making sure of the habits of the Cecidomyids. The web-hangers [*Chaetodiplosis gymnastica*, see below] I feel sure are closely related, though not the same, the chief difference being in the proboscis. I am not sure that I haven't found a second species, or a variety of the first one [*Farquharsonia*], that appears to compete with a *Cremastogaster* (on the *Teratoneura* tree) for the secretions of *Stictococcus*. It does seem a most precarious mode of existence. Without doubt, the first ones sent do take advantage of the ants in the act of inter-regurgitation. I feel confident that the anatomists will agree that the extraordinary mouth-parts are for sucking only.

[Mr. J. E. Collin wrote Feb. 13, 1920: "I believe Farquharson was undoubtedly right in considering that the proboscis of *Farquharsonia* is for sucking and not for biting. The tip of the tongue-like organ is microscopically pubescent and consequently better adapted for sucking up liquids than for piercing. Also I found no trace of maxillae, which I believe are always present in biting or predaceous insects."]

2. *Chaetodiplosis gymnastica Collin*, *sp. n.* (p. 507).

[The material includes 8 ♂ 34 ♀ hanging from threads in the hollow at the base of the ant-tree *Alstonia*, at Moor Plantation, Aug. 11, 1918. Also taken with them 1 ♀ of a distinct species. See pp. 508–509.]

Aug. 11, 1918.—Near the base [of the ant-tree *Alstonia*,

p. 369] is a large decayed hollow up the inside of which is a considerable portion of the carton nest of the ants. I found that this hollow simply swarms with them. But in addition to these it suddenly struck me that certain curious little flies, which I had often seen before on ant-trees, but neglected to study, might be the Cecidomyids *at rest*. I had often meant to write you about these curious little flies from their habit of resting habitually on a silk web not unlike the webs of some spiders. I have often seen hundreds of them hanging by their fore-legs, rows of them, on such webs, and vaguely thought they specialised in spider-webs as a resting-place. Now, however, I am in doubt as to the origin of the silk threads, and I am seriously wondering whether the flies do not make them themselves. I am not sure that they are the Cecidomyids yet, but if not they are extremely similar, and when disturbed their flight is much the same, except that they quickly come to rest again on their silk threads. The threads do not appear to be traps for other insects. They are too widely separated. The insects at rest remind one of birds on telephone wires except that they hang down. Though I did find a large bug (dead) resting on the threads, I felt sure that it had fallen on to them after death and was too big to slip through between the "lines." I readily caught a lot of them by bringing together a box and its lid held in either hand. A portion of the "web" was included and in a few seconds the little flies had hung themselves up. None of them settled on the side of the tin. Some of them were hanging with one foot on a thread and another on a leg of the nearest neighbour. To-morrow I hope to have a look at them under the microscope to get a view of their proboscis.

B. The Pursuit of living Ants by the Ephydrid, Rhynchopsilopa apicalis Collin, sp. n. (p. 509).

[Material:—2 ♂ 3 ♀, taken Dec. 25, 1917–Jan. 26, 1918, feeding from the anus of dead *Cremastogaster* ants as described in Proc. Ent. Soc., 1918, pp. xxxv, xxxvi, xl.]

Aug. 25, 1918.—While I was studying these [Cecidomyids], I noticed some of the little "proctophila" and froze on to one in particular for special observation. I am now certain that they actually pursue living ants, smaller workers, pursuing them *from behind*, with apparently the same unpleasant object. They appear to select an

ant of reasonable size (not too big) and run after it, never flying after the "victim." Contact between the fly's head and the ant's posterior end is momentary (not the deliberate and prolonged contact as in the case of the dead ants). The fly then decamps (by a short flight) in search of another. The ants appear to resent the attention most seriously, for they usually stopped dead, bent back their heads and abdomens till they all but met, remaining thus for a few seconds before running off with the abdomen in the air. Unless alarmed, *Cremastogaster* usually runs along with the whole body parallel with the surface on which it is travelling. While I repeatedly saw this happen, I could never actually see the fly absorb anything, so swift was the contact and withdrawal, but I think the flies may be definitely classified as Myrmecophilous.

C. Notes on the Life-history of Milichia argyratoides, and the Habits of other Milichidae.

1. *Milichia argyratoides Collin, sp. n.* (p. 510).

[The pill-box in which the ♂ and ♀ specimens referred to below were contained, bears the following: "Ant-flies, Mamu. 10.ix.15." A further note stated: "From Mamu, a village on the edge of a large forest reserve about 20 miles S. from Ibadan. The village called on the map Gambari is practically the same." The flies were bred out on the road.]

Sept. 28, 1915.—I sent also two small Diptera in a pill-box. I hope they arrived safely. They also are associated in the Shagamu district with the Hewitsonias and the ants. I've got a few fly larvae in spirit. They appeared to live on a running wound on the ant-tree. They covered themselves with excreta, and I saw one *Cremastogaster* carrying away some of the stuff from the surface of a larva. More pupated, but none have emerged. It is extremely difficult to look after them on the road. I had several Hewitsonias drowned in their box one day after I'd carried them for several days. We met a very heavy rain storm. Everything got wet, including my camp bed. I do hope the two small flies will be enough for identification.

April 17, 1918.—I have long wondered what the curious little Diptera of 1915 (*Milichia*) were, with their curious larvae. I hope to get back to the same district some day to get some more. I have no doubt but that they are genuinely Myrmecophilous, though they do not live inside

the nests. The larvae wander about in the run of the ants, soft, unprotected things, that cover themselves with excreta much like Criocerid larvae. The ants seemed to have a liking for this and fed on it, without at all molesting the larvae. They pupate in queer little cocoon-like things and more or less gregariously.

April 28, 1918.—When he [Mr. H. N. Thompson, Director of Forests] returns I am going for a week-end to one of his forest reserves, where I found the *Milichia* larvae, and can find many other good things too.

2. *Milichia farquharsoni Collin, sp. n.* (p. 514).

[The " haunting flies," referred to below as " absolutely guaranteed," consisted of 5 ♀, evidently captured on or around *Cremastogaster* ants' nests in May, 1918.]

Feb. 4, 1918.—There's a little black and extremely active Dipteron that haunts one of my trees and on it the huge *Cremastogaster* nest the inhabitants of which never seem to rest day or night. These little flies, in quite considerable numbers, alight on the carton of the nest, dodge about among the ants, and are always at it. Yet I've never been able to find out what they are after! A *Cremastogaster* nest is no place to sit down at, till one finds out—it is up a tree as it happens. But I've stood on a ladder till my legs ached without success. They aren't there simply for the fun of the thing I know, but that's all of their ways that I'd care to dogmatise about, and it's not very helpful.

May 28, 1918.—I told you I may possibly have sent Myrmecophilous Diptera whose exact doings I have not yet cleared up, but which haunt the nests of *Cremastogaster* instead of the real mendicants. By this mail I send a small number of absolutely guaranteed mendicants as well as a few of the others, also absolutely guaranteed. I know of still more Diptera closely related to these, and I find that the Cecidomyid occurs here also. I will write fuller notes later.

3. " *Mendicant* " *Milichidae and Mimetic Ant-flies.*

[The habits of these flies were described by Farquharson in Proc. Ent. Soc., 1918, pp. xxxiii, xxxiv, xl. The specimens sent in illustration and captured between Dec. 23, 1917, and Jan. 26, 1918, included three distinct species (at first only two were recognised, *ibid.*, pp. xxxiii, xl) described by Mr. Collin on pp. 512–14, viz. *Milichia proectes*,—1 ♂; *M. prosaetes*,—1 ♂, 1 ♀; *M.*

dectes,—1 ♀. The "absolutely guaranteed mendicants" referred to above were received July 18, 1918. In mounting the specimens these "mendicants" were kept distinct from the "haunting flies"—*M. farquharsoni*, but the relationship to the notes was inadvertently lost, so that at first it was impossible to determine which group was "haunting" and which "mendicant." They were all carefully labelled (1) and (2) and sent to Mr. Collin, who found in (2) two of the "mendicant" species sent before, while (1) contained only the 5 ♀ of the hitherto unseen species *M. farquharsoni*. It was therefore certain that the latter are the "haunting flies." Group (2) of "absolutely guaranteed mendicants" contained *Milichia prosactes*,—4 ♀; *M. dectes*,—2 ♂, 3 ♀, all captured, evidently in May, 1918, on *Cremastogaster* ant-trees.

The following extracts show that there are still other, probably undescribed, species of Milichidae to be found associated with *Cremastogaster* in S. Nigeria, together with an "ant-mimic" which cannot be placed with certainty. Mr. Collin wrote, April 17, 1921: "When one remembers that Farquharson found a Cecidomyid and an Ephydrid under circumstances and with habits so completely different from what one would expect in a member of either family, one hesitates to offer an opinion on the identity of the other small fly whose habits he describes."]

April 28, 1918.—I am to look more carefully into the mendicant flies. There are at least two others that share Coccid secretions with the ants, one with the underside of the abdomen a silvery white. They are all associated with the same ants, and I may have sent them by accident mixed with the mendicants. However, I'll get more and so clear up the point. I should say they all belong to closely related genera. I saw the mendicants busy this forenoon.

Aug. 11, 1918.—At the same time [viz. when observing the Cecidomyids] I found some of the little "proctophila" besides another small fly that appears to be an ant-mimic (in spite of its wings). It wanders about among the ants keeping its wings in motion all the while in the manner of Ortalid flies when they settle, and appears to feed on undefined matter on the somewhat moist surface of the hollow tree. They settle among the ants and dodge about with extraordinary freedom.

Aug. 25, 1918.—When I was studying the Cecidomyids to-day I collected some of the mimetic flies of which I told you. They simply dodge amongst the ants and lick

up their food, whatever it be, from the surface of the tree-trunk. I can see their proboscis in the act. Viewed at certain angles (when the wings cannot be seen), they are really very like the ants themselves.

D. The Prey of the Asilid Fly Philodicus temerarius Walk. (Asilinae).

[The following table of captures made within a few days, by one species at one place, shows the existence of very comprehensive tastes. The only prey hitherto recorded for *Philodicus* includes but one Lycaenid and one Tachinid (Trans. Ent. Soc., 1906, p. 344). The allied Asilids exhibit a marked preference for Lepidoptera and Orthoptera (*ibid.*, pp. 372, 373). Of the 13 victims here recorded, 5 are Diptera, 3 Orthoptera, 3 Hemiptera, and 2 Homoptera. In identifying them I had the kind help of Dr. Guy Marshall, and, with the Diptera, of Prof. M. Bezzi and Mr. C. G. Lamb.]

Agege: 1917.	*Philodicus temerarius.*	Prey.	
Oct. 21	♂	*Tettigoniella cosmopolita* Sign. (Jassidae: Homoptera).	
,, ,,	♂	♀ fly, probably of genus *Paralimna* (Ephydridae).	
,, ,,	♂	The Capsid bug *Proboscidocoris* sp. A.	
,, ,,	♀	♂ fly, probably of genus *Paralimna* (Ephydridae).	
,, ,,	♀	♀ Anthomyid fly, *Coenosia* sp.	
,, ,,	♀	Immature Acridian, *Acrydium* (*Tettix*) sp.	
Oct. 22	♀	The Capsid bug *Proboscidocoris* sp. A.	
,, ,,	♀	*Tettigoniella cosmopolita* Sign. (Jassidae: Homoptera).	
,, ,,	♀	Immature Acridian, *Acrydium* (*Tettix*) sp.	
Oct. 24	♂	The Capsid bug *Proboscidocoris* sp. A.	Prey of the 4 *Philodicus*. Individual captors not recorded.
,, ,,	♂	A Gryllid, *Euscirtus* sp., probably new.	
,, ,,	♀	♂ fly, probably of genus *Paralimna* (Ephydridae).	
Undated.	♂ and ♀ *in cop.*, ♀ with prey.	♂ Anthomyid fly, *Coenosia* sp.	

E. The Tachinid Fly Bengalia attacking Termites.

[See Proc. Ent. Soc., 1919, p. lii–lviii and references quoted, for evidence that *Bengalia* seeks Termites because it is unable to penetrate any but very thin-skinned insects or those which have been bitten by ants. See also Trans. Ent. Soc., 1906, pp. 394–396 and references, for the habits of the allied Oriental *Ochromyia jejuna* F.]

Agege.

Oct. 18, 1917.—One little incident of the great *maculatus*-Lycaenid find [p. 392] I might just add while I remember it. When the Termitary was broken up the white ants were of course scattered over the ground, and, in no time, I am sure there were not less than a dozen Bengalias hawking around, to whom the feeble Termites fell an easy prey. At Ibadan some time ago I got one of these enterprising flies in the act of attacking, successfully, a de-alate *Termes bellicosus* the morning after a nuptial flight, and I have even seen them tackle a fair-sized Noctuid larva.

VI. HEMIPTERA.

The Procryptic Appearance and Attitude of certain Hemiptera on an "Ant-tree."

[Unfortunately no specimens were sent and the species cannot be identified. Dr. G. A. K. Marshall thinks it is fairly certain that the species was a Pentatomid, for this family includes several W. African species that frequent tree-trunks and are more or less lichen-like. *Atelocera* is perhaps the most likely genus.]

March 20, 1915.—I found some very curious bugs the other day on a tree here. Perhaps Lamborn sent you them before. The nymphs were resting on the lichen-covered bark of a large tree and looked greatly like a large scale insect; they rested on the surface absolutely motionless, and were so like the lichen that I failed to notice them during a considerable interval during which I was looking at some ants which nest in that particular tree. The ants did not seem to mind them. So perfectly quiet were they that I thought they were large scale insects. Concealed in deep cracks on the bark I found some of the mature bugs, not so well protected as the nymphs by their colour. This protection, in virtue of their power of flight, and their odour when disturbed, the adults would not require, though they were by no means conspicuous. They rested in groups of three or four together.

APPENDIX.

A. NEUROPTERA.

I. *Description of a new Species of Embiidae from Southern Nigeria.* By Prof. F. Silvestri.

Plates IX, X.

Embia (Rhagadochir) apicata, sp. n.

♂. Corpus (exsiccatum) castaneo-nigrescens thorace ochraceo-ferrugineo, antennarum parte distali albicante, alis castaneis lineis intervenalibus albis, pedibus castaneis, cercis castaneis parte distali albicante.

Caput subaeque longius (labro excluso) atque latius (oculis inclusis), lateribus pone oculos gradatim parum convergentibus, angulis posticis rotundatis, superficie setis brevioribus et brevissimis vestita. Oculi reniformes, aliquantum prominentes. Antennae 24-articulatae attenuatae, articulo primo subcylindraceo quam ceteri aliquantum latiore, articulo tertio c. 1/3 longiore quam latiore et quam secundus etiam c. 1/3 longiore, articulo quarto secundo longitudine subaequali, articulo decimo parum minus quam dimidium longiore quam latiore, articulis omnibus setis numerosis subtilibus sat longis instructis. Mandibulae apice bidentato instructae.

Pronotum postice parum latius quam longius, lateribus partem anticam versus aliquantum convergentibus, setis numerosis brevibus instructum; mesonotum margine antico setis longis antrorsum nec non setis numerosis medianis subanticis instructum; metanotum nudum scuti margine postico subrecto. Alae venis *vide* Pl. IX, 1–3.

Pedes setosi, primi paris tarsi articulo primo, subtus menso, parum magis quam duplo longiore quam latiore, tertii paris coxa, lateraliter mensa, duplo longiore quam latiore, secundi et tertii paris tarso *vide* Pl. IX, 5, 6. Abdomen setosum segmenti ultimi forma et cerci *vide* Pl. IX, 7, 8.

Long. corp. cum alis mm. 12·5, sine alis 10·5, lat. capitis (cum oculis) 1·60, pronoti partis posticae 1·30, mesonoti 1·56, long. antenn. 6·5, alae anticae 10·3, lat. ejusdem 3, long. ped. paris tertii 5.

♀. Corpus nigrescens prothorace testaceo-ochraceo, antennis parte distali albicante, pedibus nigrescentibus, coxis, trochanteribus testaceo-ochraceis, tibiarum basi et secundi et tertii paris tarsis aliquantum rufescentibus.

Caput subellipticum, paullum longius quam latius, lateribus late convexis, oculis vix prominentibus. Antennae in exemplo typico haud integrae, articulo tertio quam secundus vix longiore, articulo decimo vix longiore quam latiore. Mandibulae (Pl. X, 5) apice unidentato, parte molari transverse profunde sulcata.

Thorax pronoto subtrapezoideo, mesonoti scuto quam idem metanoti parum longiore et paullum angustiore.

Pedes primi paris tarsi articulo primo, subtus menso, parum magis quam duplo longiore quam latiore, paris tertii femore, lateraliter menso, parum magis quam 1 3 longiore quam latiore, secundi et tertii paris tarsi *vide* Pl. X, 1–3.

Abdomen a segmento septimo parum, a segmento octavo aliquantum angustius, tergiti decimi margine postico rotundato, cercis *vide* Pl. X, 4.

Long. corp. mm. 14, lat. capitis 2·2, pronoti partis posticae 1·60, mesonoti 2, long. pedum paris tertii 5·6.

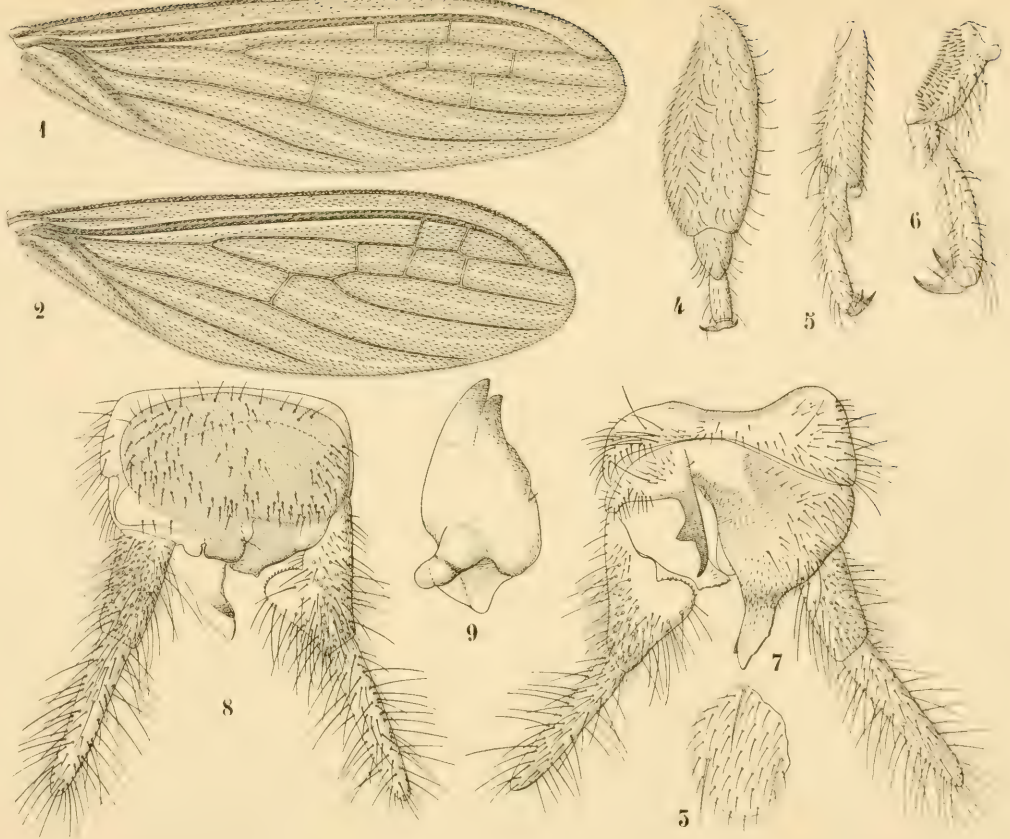
[Two ♂ and 2 ♀ from webs on Pará Rubber trees at Agege, near Lagos: 1917–1918. For notes on the webs and enclosed Embias see pp. 413–16.—E.B.P.]

Larva. Corpus totum testaceum. Antennae 15–19-articulatae, articulo tertio quam secundus aliquantum longiore.

Long. corp. mm. 7; lat. capitis 0·92.

[These larvae were from the cotton-seed sacks at Moor Plantation (pp. 415–16). Prof. Silvestri wrote concerning them, Jan. 12, 1921: "It is very probable that these larvae belong to the same species as the ♂ and ♀, but one cannot be absolutely certain if they were not collected near the adults. The web and the environment of the larva may be rather different from those of the adults."—E.B.P.]

Observatio. Species haec ad *Embia* (*Rhagadochir*) *vosseleri* End. proxima est, sed colore et maris partis laevae tergiti decimi forma saltem distincta est.



Trans. Ent. Soc. Lond., 1921, Plate IX.

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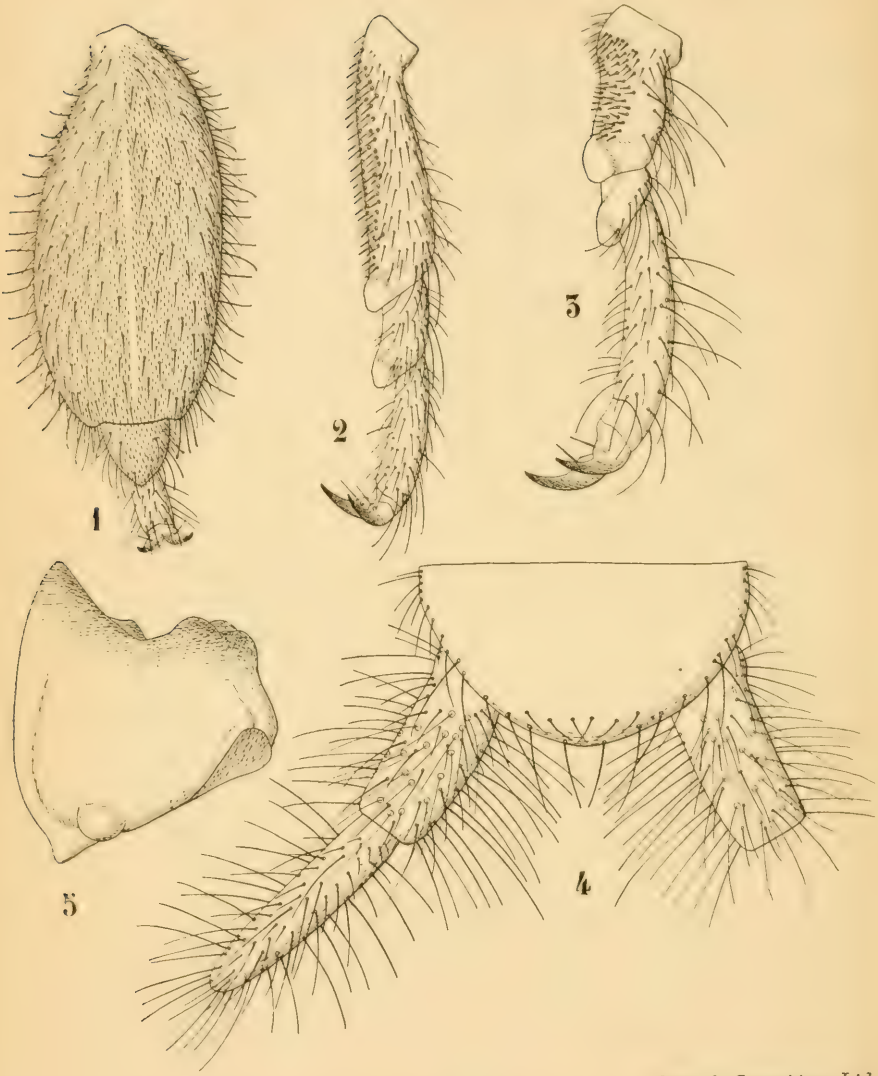
EMBIA (RHAGADOCHIR) APICATA Silvestri (male)



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EMBIA (RHAGADOCHIR) APICATA Silvestri (female).

Explanation of Plate IX.

Embia (*Rhagadochir*) *apicata*, mas: 1, ala antica; 2, ala postica; 3, alae particula, multo ampliata; 4–6, pedum primi, secundi et tertii paris tarsus et praetarsus; 7, corporis pars posterior a segmento nono prona; 8, eadem supina; 9, mandibula dextera supina.

Explanation of Plate X.

Embia (*Rhagadochir*) *apicata*, femina: 1–3, pedum primi, secundi et tertii paris tarsus et praetarsus; 4, corporis pars posterior a segmento decimo; 5, mandibula dextera supina.

II. *Corrodentia: Psocidae. On a new Southern Nigerian Psocid.* By Prof. R. Newstead, F.R.S.

Plate XI. Text Figure 1.

Psocus nigeriensis, sp. n.

General colour of body dusky ochraceous, legs slightly paler than thorax with the distal extremities of the tibiae dark brown or black; spines on the legs dark brown or black; nasus sometimes with very faint traces of dark brown, interrupted, vertical markings. Antennae with the first three segments slightly paler than the thorax, the rest dark brown or blackish. Wings with the venation normal, perostigma very faintly infuscated; there is also a small faintly infuscated area immediately below the superior

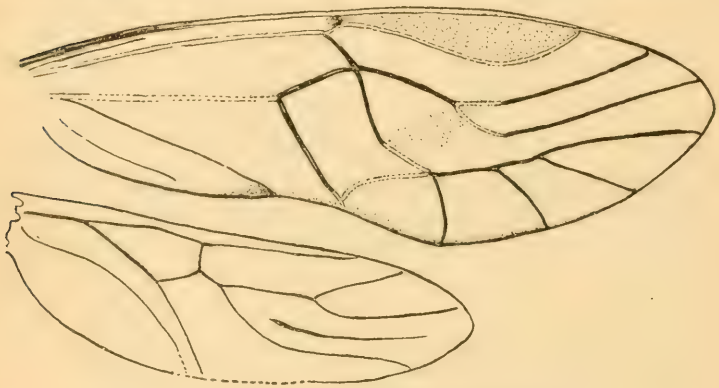


Fig. 1. *Psocus nigeriensis*, Newstead.

apical furcation; the transverse vein and the proximal branches of the forked vein (forming roughly the cursive numeral 4, upside down on the left and also retrograde on the right), also the veins enclosing the marginal cellules 2–4, and the major portion of the superior apical furcation, intense dark brown to blackish; the remaining portions of the veins faintly indicated and almost colourless. Eyes either partially or entirely black.

♀. Number of antennal segments doubtful (ten were counted in one individual, but this appeared to be imperfect); 1st and 2nd segments very short and the former moniliform and much stouter than the 2nd; 3rd and 4th equal in length, and about ten times longer than the 2nd. Maxillary palpi (Pl. XI, *a*) with the 2nd seg-

ment nearly equal in length to the 4th, all the segments with fine stiff hairs. The long, "slender, curved, horny process" (Westwood) or maxillary fork normal (Pl. XI, *b*). Mandibles (Pl. XI, *c*) asymmetrical, tridentate distally, inner surface, at the base, with a large and somewhat quadrate tooth-plate or rasp-like structure composed of 16 rows of minute teeth (Pl. XI, *c*1); immediately above this on the inner margin of the right mandible is a small blunt tooth. Lingua (Pl. XI, *d*) composed of two broad, blade-like processes the edges of which are folded over and finely but bluntly serrate, the two structures fused in the middle line so that collectively they form a trough-like process. Pharynx or pharyngeal sclerite strongly chitinised and leading from this is a strongly defined chitinous chord or "lingual duct" (Pl. XI, *d*1) which bifurcates just beyond the middle distance, one branch going to each of the two blade-like structures ("lingual glands") respectively, each one terminating at the anterior margin where they are apparently connected with a small opening or channel. Tibiae of all the legs thickly clothed with long, stiff spines (Pl. XI, *e*) each of which is partly surrounded, at the base, by a minute coronet of short stiff spines; tarsi of two segments, those of legs ii and iii (Pl. XI, *e*1) with a closely packed series of long stout curved spines, each surrounded by a coronet of short spines ("ctenidiobothrien"), similar to, but much larger than, those on the tibiae; on the proximal segment of leg ii there are 13 and on the distal one 3; on leg iii there are 24 and 6 respectively. Abdomen very sparsely clothed with minute hairs; distal segments (Pl. XI, *f*) with the sclerite of the 9th abdominal sternite of three processes, the median one more or less pointed, the laterals (Pl. XI, *f*2) quadrate with the distal margin furnished with small bluntly pointed spines; terminal segment with two pairs of spine-like processes (Pl. XI, *f*1) the lower pair much the larger.

Length of specimen restored in KOH, 3·5 mm.

Length of fore-wing, 6·3 mm.; total expanse of wings, 14 mm. approximately.

♂. Abdominal hairs longer and more numerous than in the ♀. Genital armature of the only example before me, has not restored sufficiently in the KOH to enable me to determine the morphological characters with any degree of exactness. I can only add that the lateral lobe-like extensions are rather thickly studded with very long hairs (Pl. XI, *g*) each of which is surrounded by a rosette-like pattern.

West Africa: Agege, S. Nigeria, gregarious on the bark of Pará Rubber (*Hevea brasiliensis* Müll. Arg.);

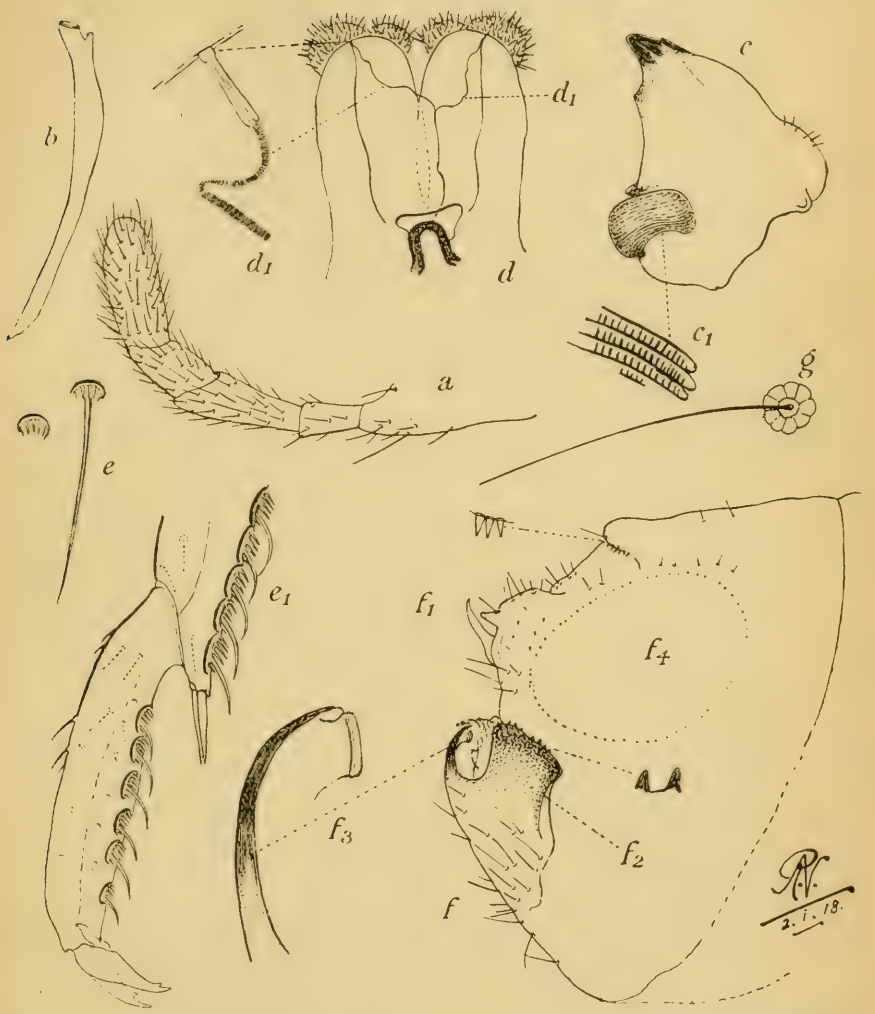
22.ix.17. See pp. 418-20 for an account of the habits of this and two other species.

This somewhat remarkable species is nearly allied to *Psocus kiboschoënsis* Enderlein;* but the fore-wings are much longer and the structural characters of the pygidium of the female, together with the greater number of "ctenidiobothrien" on the tarsi, readily distinguish it.

* Der Schwedischen Zool. Exp. Kilimanjaro-Meru; 3B, p. 31, taf. 5, figs. 2, 8 (1910).

Explanation of Plate XI.

Psocus nigeriensis Newst. ♀: *a*, maxillary palpus; *b*, maxillary process; *c*, mandible; *c*1, compound tooth-plate; *d*, lingua; *d*1, chitinous chord; *e*, compound spines (ctenidiobothrien); *e*1, tarsus with the ventral compound spines; *f*, pygidium in profile; *f*1, spine-like processes; *f*2, one of the quadrate sclerites; *f*3, median sclerite; *f*4, the dotted ovate line indicates the position of one of the faecal pellets. *g*, ♂: rosette-like platelette and hair on the anal lobes.



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PSOCUS NIGERIENSIS Newstead.

B. HYMENOPTERA.

III. *On a new Joppine (Ichneumonidae) Genus and Species bred from a Lycaenid Larva in Southern Nigeria.*

By James Waterston, B.D., D.Sc., Assistant in the Department of Entomology, British Museum, Natural History.

Text Figures 2, 3.

The single Ichneumonid in Mr. Farquharson's collection, though represented by only one example with defective antennae, has proved to be of great interest. A prolonged study of this specimen convinced me that it must be assigned to the Joppinae, and further that it was referable to no described genus. At my request Dr. A. Roman of Stockholm examined the insect, and his opinion as to its systematic position agrees with that just expressed. For this kindness and further for drawing my attention to the importance of the host attachment (*vide infra*) of this new genus I desire to express my hearty thanks.

The genus *Adelotropis* (*ἄδηλος, τρόπις*) is easily recognised by antennal and neurational characters and the genotype in all probability by colour and puncturation.

Fam. ICHNEUMONIDAE.
Sub-fam. Joppinae.

Adelotropis, gen. nov.

Head as wide as thorax. Frons smooth, without carina between the antennae. Face medianly raised, the swelling defined with moderate sharpness just below the toruli and fading out towards the clypeus. The latter not separated from the face medianly but shallowly at the sides (towards the ends of the tentorial apodemes). Inner orbits a little divergent towards the mouth edge. Occiput and genae smooth. The latter slightly swollen posteriorly so that in profile the genae are not margined. The occipital margin, fine but distinct and thinning out ventrally, reaches the mouth edge as a delicate line perceptible only from behind. The first normal funicular joint (post annellus) shorter than the second which is longer also than its successors. Thorax robust; notauli shallow and indistinct; scutellum deeply separated from scutum and bluntly, conically, elevated with a broad raised flange which is apically defective. Propodeon dorsally short, deeply separated

from postscutellum, its areae almost completely but in places indistinctly indicated. Spiracles rather narrow. Wings. The outermost (3rd) abscissa of the radius is straight and the 2nd recurrent broken just below ½ and with a rudimentary external branch. In the hind-wings the nervellus is very slightly antefurcal and broken at its lower extremity. The discoidella emitted here and the posterior beyond this point are spurious.

Abdomen, 2nd segment with pronounced punctate striate sculpture; gastrococli large. Hind-legs, especially the femora, robust, tarsal ungues strong, simple.

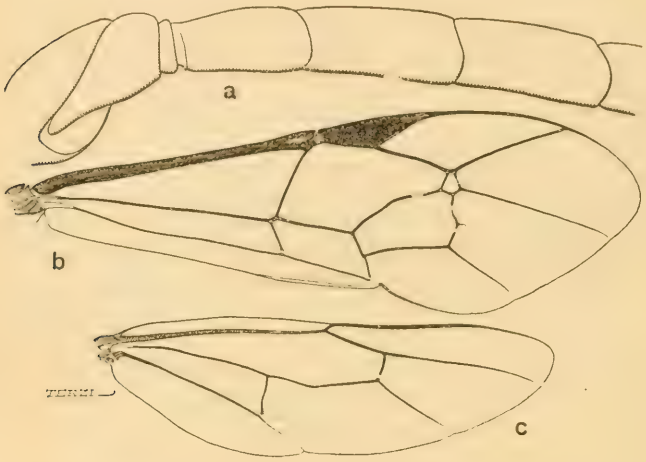


Fig. 2. *Adelotropis farquharsoni*, sp. n., (*a*) Basal joints of antenna, (*b*, *c*) Wings.

In its genal characters this genus closely resembles *Joppa* F., but its affinities on the whole are with the genera *Anisobas* Wesm., *Listrodromus* Wesm., and *Neotypus* Först., particularly with the latter. A further indication of the relationship of these four groups is to be found in their host attachment—all of them parasitising Lycaenids.

Genotype the following.

Adelotropis farquharsoni, sp. n.

♀. Head and antennae, up to the 8th normal funicular joint, blackish brown except for one large pale spot at the base of the mandible, a second along the inner orbit of the eye extending

upwards to the level of the anterior ocellus and inwardly to the edge of the torulus and a third narrow and indistinct along the posterior orbit on its upper $\frac{1}{3}$. Thorax dark ferruginous, propodeon more infuscated especially antero-dorsally. Legs and abdomen blackish brown, the fore and hind tarsi slightly paler. Apex of

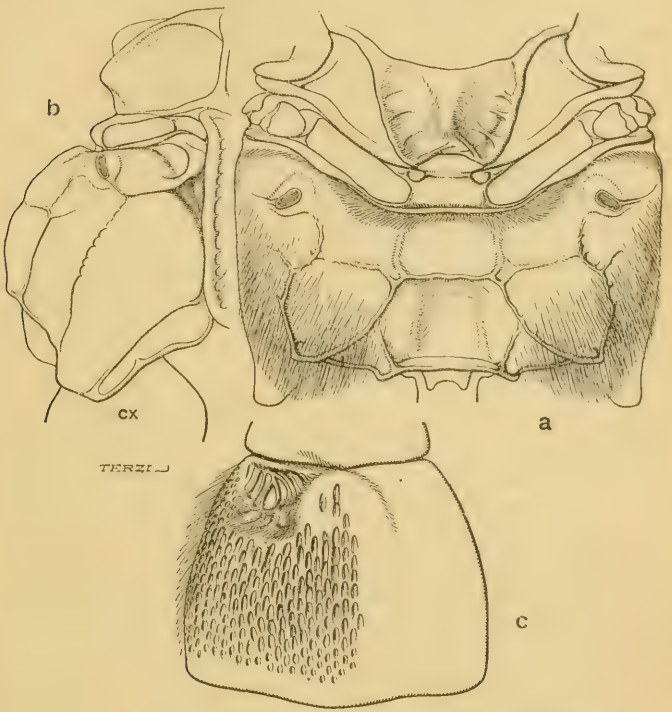


FIG. 3. *Adelotropis farquharsoni*, sp. n. (*a*) Propodeon from above, (*b*) Propodeon in profile, to show the areae. The puncturation is not expressed. (*c*) Post petiole and succeeding tergite, to show puncturation of the latter. (*cx*) Coxa.

hind coxae and hind tibial spurs pale. The abdominal tergites from 4 onwards broadly yellowish white apically, as is also the upper half of the sheath of the terebra.

Head, occiput to genae shining with only a few scattered punctures behind the ocelli; vertex with a few punctures (minute) anteriorly at the sides of the ocellar triangle. Frons smooth and finely and sparsely punctate at the sides on the pale spots. Face and clypeus dull, closely and finely punctate.

Thorax. Mesonotum (including scutellum) with rather large coarse sparse but even puncturation. Mesosternopleurae more closely punctate; upper part of furrow smooth: posteriorly before the epimeron, it is crenulate. Metapleurae deeply sunk. Propodeon. With care all the areae can be made out but the best-defined keels are those bounding the dentiparal area which postero-laterally bears a low inconspicuous tooth best seen from above (fig. 3*a*). Fairly distinct too are the keels above and below the pleural area (fig. 3*b*).

Basal area and areola confluent and nearly merged with the external areae. The dorsal surface of the propodeon within these areae shining and smooth but irregular, such punctures as are present being near the sides of the areae. Juxta-coxal, pleural, spiracular and posterior areae dull, with coarse close puncturation. Particularly at the sides and posteriorly (*i. e.* over the punctured surfaces) the propodeon is clothed with a dense whitish pubescence.

Wings (see fig. 2*bc*). About 10 hooks on the costa of the hind-wings.

Legs. Hind coxae externally coarsely and closely, the hind femora more finely, punctured.

Abdomen. Petiole smooth shining expanding distally to the wide post petiole. The latter intumescent between and round the small broadly oval spiracles. On the petiole itself are a few elongate punctures deeper anteriorly than posteriorly: apically the punctures become more numerous and coarser especially beyond the spiracles at the sides.

The 2nd (3rd) segment (fig. 3*c*) has a deep coarse puncturation, the punctures for the most part drawn out and deeper anteriorly so that the surface has a sub-aciculate appearance. The 3rd (4th) tergite is similar to the second and also basally crenulate. The remainder of the dorsal surface is smooth.

Length, about 8 mm.

Alar expanse, about 14 mm.

One ♀ bred March 22, 1917, from the larva of a Lycaenid, probably *Deudorix diyllus* Hew., feeding on the flowers of *Pterocarpus esculenta*, at Moor Plantation, near Ibadan, S. Nigeria (p. 382).

IV. *On Chalcid Parasites bred from Pupae of Teratoneura isabellae.* By James Waterston, B.D., D.Sc.

[In a letter of Oct. 18, 1917, Farquharson spoke of sending "two *Teratoneura* pupae from which Chalcids of two kinds emerged. I have more in reserve." (See also his notes on pp. 346–47.) Of the pupae sent, one, A, had yielded, on March 5, 1917, 245 minute Chalcids; from the other, B, found Feb. 21, 1917, a single large female, identified by Dr. J. Waterston as *Chalcis ? leighi*, emerged March 2. The material in reserve arrived later and consisted of 152 minute Chalcids, which emerged Feb. 20, 1917, from a pupa, C, which was not received. These 152 examples were larger than those from pupa A, but considered by Dr. Waterston to belong to the same species *Tetrastichus balteatus*. That the 245 should be smaller than the 152 was to be expected, but that the proportion of males in the larger number should be so much higher (2 to 5 as against 2 to 17) suggests further inquiries which may lead to conclusions of much interest. Dr. Waterston has kindly written (Sept. 18, 1919, and Feb. 29, 1920) the following account.—E.B.P.]

re *Chalcids from* Teratoneura.

There are in this material two species :—

(*a*) *Eulophidae*—Genus *Tetrastichus*.

Tetrastichus balteatus Waterst. (Bull. Ent. Res. VI, Pt. III, Dec. 1915, p. 241, figs. 4, 6).

Of this species there are [altogether from pupae A and C] 86 ♂ and 311 ♀ (*i. e.* 21·66 % of the total—397) which agree well with the type material bred from the pupa of a Lymantriid moth, Port Herald, Nyasaland. There are some slight differences in the proportion of the funicular joints (♂) which do not appear to be of specific value.

I cannot discover that more than one species is represented. The difference in size which struck you is partly sexual, the female being on the average considerably larger than the male, partly also I believe a matter of nutrition. Sorting the material roughly by size there are two lots of

larger and smaller examples respectively. These lots analyse as follows :—

	Mounts.	♂	♀	
Larger examples .	12 "C"	16	136	*i. e.* 2 ♂ to 17 ♀
Smaller examples .	12 "A"	70	175	*i. e.* 2 ♂ to 5 ♀
Totals . . .		86	311	

I take it that "C" and "A" refer to separate pupae of *Teratoneura*. If so the difference in size is apparently due to the fact that in the A lot not only was the parasitism heavier but the ratio of males to females over three times higher.

(*b*) *Chalcididae*—Genus *Chalcis*.

Chalcis ? *leighi* Cam. (Ann. S. Afr. Mus., vol. v, 1907, p. 210). One ♀ from pupa B.

Cameron's species rests on the unique and imperfect type in the B. M., and a complete comparison has not been possible. In your example the puncturation of the hind femora is hardly so heavy, nor is the base of the hind tibia so pale above as in the Natal insect. But the two are extremely close if not identical, as I incline to think they will prove to be.

C. LEPIDOPTERA.

V. *Description of new Species of Lepidoptera, chiefly Lycaenidae from Southern Nigeria, and one from Damba Island, Victoria Nyanza.* By G. T. Bethune-Baker.

a. Liptenínae.

Epitola lamborni, sp. n.

♀. Primaries, upperside, costa broadly dark ash-grey, termen broader and darker grey, cell and basal three-quarters of fold covered with very pale blue scales over a whitish ground which shows through as a white spot beyond the end of the cell and as three or four larger spots in the postmedian area; there is a blackish blotch beyond the lower angle of the cell and another at the upper angle; these are more narrowly confluent between veins 4 and 5. Secondaries pale ash-grey with the basal and median areas between veins 1 and 6 covered with very pale blue scales. Fringes whitish with the veins darkly intersecting.

Underside, both wings white with grey markings. Primaries with three spots in the cell, a grey area all round the cell with a good deal of white scaling over it, this grey area is projected right outwards between veins 3 and 4 but recedes somewhat basewards, above vein 4 it recedes and is sharply crenulate, a very irregular white area follows and is succeeded by two rows of very pale grey crenulate markings obsolescing towards the tornus. Secondaries with a basal grey dash, two sub-basal grey spots across the cell, beyond which is a series of about 5 confluent spots across the middle of the cell which is closed by a narrowish dash with a whitish centre, most of the spots have also more or less whitish centres; beyond the cell a very irregular crenulate area of grey and whitish, an irregular broadish clear whitish area follows and is succeeded by two submarginal crenulate grey lines with whitish filling between; termen finely grey.

Expanse 40 mm.

Hab. Moor Plantation, near Ibadan, S. Nigeria.

Type in the Oxford Museum.

I name this after the wonderfully assiduous and able naturalist who bred it on Oct. 29, 1913, from a pupa found two days earlier.

Epitola carpenteri, sp. n.

♂. Upperside, both wings dark brown with the basal and median areas quite covered with somewhat lustrous darkish blue scales which extend almost to the termen in the secondaries. Underside, primaries brown with the median area dark grey and in the postmedian area there is a well-defined paler area crenulate at its inner margin in the fold, whilst beyond the cell is a trace of two small paler spots which are separated from those on the fold by a dash of the dark ground-colour. Secondaries uniformly brown.

♀. Upperside, primaries dark brown, below the cell whitish with a slight superimposition of very pale blue scales, a largish white spot between veins 2 and 3 in the postmedian area, and an oblique series of small white spots in the same area just below the costa. Secondaries pale grey with bluish scaling in the basal and median areas. Underside with the bluish and white areas and spots repeated in white, the postmedian spots being separated by a broad dash of the blackish ground-colour about vein 4, otherwise like the male.

Expanse ♂ 38, ♀ 34 mm.

Hab. Damba Island, N.W. Victoria Nyanza, about 20 miles S.E. of Entebbe: ♂—jungle, E. side of island, between Sept. 1 and 15, 1911: ♀—on shore, E. side, July 14, 1911. Mar. 16–May 31 was much the wettest part of Dr. Carpenter's visit, from Mar. 16 to Dec. 22.

Types in the Oxford Museum.

I name this species after its captor. At first I was almost inclined to consider it was a form of *E. cephena* Hew., but further comparison makes me feel it cannot be so.

b. Lycaeninae.

Epamera farquharsoni, sp. n.

♂. Upperside, both wings lustrous bright azure blue. Primaries with the blue area rounded off so as to leave the upper end of the cell black and not extending into the tornus, it thus leaves the tornus and the apical half of the wing deep black. Secondaries entirely blue except the costa which is grey from vein 6, a large shiny leaden grey roundish sexual patch occupies the cell and somewhat around it. The apex of the wing is narrowly black with a linear black termen. The two tails are black tipped with white whilst the lower longer one is fringed with white as well. Underside, both wings pure white. Primaries with a trace of a straightish

very fine grey postmedian line to vein 2, a very large patch of black sex hairs from the inner marginal lobe. Secondaries with a fine distinct dark grey postmedian line, consisting of curved internervular dashes more or less confluent below vein 2 angled and receding to the inner margin, a yellowish submarginal line, a black spot in orange between veins 2 and 3, and another spot on the anal lobe surrounded with carmine and with broad red internal edging and also with a trace of mauve metallic scaling.

♀. Upperside, primaries with the black area smaller in proportion and the blue area much less brilliant and paler fading into whitish at its outer margin. Secondaries with the blue as in the primaries not lustrous and much paler, and with three small marginal anal black spots with orange internal edging. Underside, both wings as in the male but the markings more definite.

Expanse ♂ 38, ♀ 42 mm.

Hab. Moor Plantation, near Ibadan, S. Nigeria.

Types in the Oxford Museum, 2 ♂ 7 ♀. All were bred from larvae feeding on flowers of *Loranthus incanus* parasitic on *Funtumia elastica* (see pp. 362–63).

Deudorix odana H. H. Druce.

♀. Upperside, both wings dull lavender grey with broad dusky external margins. Underside, just like the male but whiter.

Expanse 44–46 mm.

Two examples, bred by Farquharson at Moor Plantation.

There appear to be two forms of this species in both sexes. In the Farquharson specimens the undersides are white, the females even whiter than the males. On the upperside the Farquharson females are grey. In my own collection the under surface of the male is dark grey, whilst my two females are uniformly brown above and pale stone-grey beneath, the pattern in both cases being typical. My specimens are from Sierra Leone and the Cameroons.

[After hearing of the above-described variation in colour, I sent two of the most divergent of Lamborn's males from Oni to Mr. Bethune-Baker, who compared the armatures with those of his own forms and found all precisely the same.—E.B.P.]

I have been unable to find any record of a description of the females of this and the two following species, and as there are specimens of all, bred with their males by Farquharson at Moor Plantation, near Ibadan, S. Nigeria (see pp. 378, 381), it is well to make the record.

Deudorix (Pilodeudorix) diyllus Hew.

♀. Upperside, both wings uniform dark brown with pale grey fringes. Underside, stone grey with the markings narrow exactly like the male.

Expanse 31–34 mm.

Deudorix (Pilodeudorix) camerona Plötz.

♀. Upperside, both wings dark brown with the basal half having a somewhat leaden tinge. Underside, pale brownish (not the cold leaden grey of the male) with all the markings precisely as in the male but slightly larger. Fringes darkish grey.

Expanse 35–38 mm.

c. Heterocera: Lithosiinae.

Chionaema farquharsoni sp. n.

♀. Upperside, white. Primaries with a sub-basal curved scarlet stripe, median scarlet stripe slightly curved, postmedian stripe very slightly angled below the second black spot and from there inclined outwards; termen scarlet broadish in the apical area, two black spots, the first in the cell, beyond the middle, and the second at the end of the cell.

Expanse 25 mm.

Type in the Oxford Museum, a female bred 1916–17 from a cocoon found on the *Cremastogaster* ant-tree, *Alstonia congensis*, at Moor Plantation.

This appears to be near *Chionaema pretoriae* Distant. The cocoon is ovate in shape, and is entirely covered, hedgehog fashion, with a dense clothing of fine long hairs which are pennate, consisting of a main quill from which emanates on each side a series of fine hairs (see also p. 488).

VI. *Notes on two Lipteninae collected by C. O. Farquharson.* By Prof. E. B. Poulton, F.R.S.

a. The Mimetic Pattern of Teratoneura.

At the time when the first specimen (p. 339) was received, the only example that I knew of in any collection was the male type of *isabellae* Dudgeon, in the British Museum. The arrival of the female made possible the full consideration of the probable bionomic significance of the pattern. The upper surface is clearly mimetic of the male *Planema epaea* Cram., which is the primary model of several other species. The female *Teratoneura*—having somewhat smaller, less reddish, paler orange markings, with comparatively dyslegnic borders—is a better mimic than the male. In addition to the mimicry of the male *epaea*, this Lycaenid appears also to exhibit secondary resemblance to certain other species of *Lipteninae*—to the female of *Telipna acraea* Westw., the male of *Mimacraea fulvaria* Auriv., both male and female *M. dubitata* H. H. Druce, and more distantly to the male of *M. apicalis* Sm. and Kirb., with a pale subapical bar to the fore-wing.

Farquharson wrote on Feb. 28, 1917, concerning the mimicry of *Teratoneura*: "Although the upper-surface colours are rather Acraeine-like, I have not observed any Acraeines near the tree nor any of those whose flight is anything like as rapid as that of the Lycaenid. When at rest the wings are folded and the lower wings take up rather a curious position so that their tips project above the line of the anterior pair. The poise is on the whole rather Skipper-like."

Although it is usual for models and mimics to frequent the same type of country and to be found flying together, examples of forest species mimicking those of more open country are well known. The flight of a mimicking species is commonly more rapid than that of its model.

b. The Synonymy of Citrinophila tenera Kirby. The Patterns of the Sexes differ as do those of the Model, Terias. J. Röber's recent Criticisms.

As there is a fine series of 31 males and 14 females of this form at Oxford, nearly all captured at Oni by Mr. W. A. Lamborn, it seemed advisable to take this opportunity of clearing up the synonymy. By the kind-

ness of Mr. J. J. Joicey I have been permitted to study the four Kirby types in the Grose-Smith collection—*limbata* and *marginalis*, both males, from the Cameroons, *tenera* and *similis*, both females, from Gaboon and Ashanti, respectively. Aurivillius ("Rhop. Aethiop.," p. 269), considers *limbata* a synonym of *tenera*, and *marginalis* of *similis*, which also "= ? *tenera*." Dr. Eltringham and I entirely agreed with this last suggestion which would sink the other three names to *tenera*. We had not the slightest doubt that all four are conspecific and only differ in variable features of the pattern. In fact so far as the male types are concerned there was no difference at all worth mentioning, both types coming from the same locality, *marginalis* being slightly the larger and paler of the two, the latter distinction apparently due to its being a little more worn. The two female types differ in a variable feature—the black margin of the hind-wing upper surface—that of *tenera* being narrow and interrupted, forming a beaded *Mylothris*-like border, the beads developed at the ends of the veins, the interruptions internervular. The under surface of both wings is similarly beaded, but this is a common feature in all forms of the species. The name *similis* may be conveniently retained for female forms of *tenera* with the black margin of the hind-wing upper surface continuous and not beaded. This form is evidently much commoner than the type, and 13 out of the 14 Oni females belong to it, the 14th, with its black margin reduced to scattered dots but not beaded, being transitional to the *tenera* ♀ form. The whole of the 31 males are fresh, bright specimens, precisely like the type of *limbata* except for the absence in the latter of a small central black spot on the hind-wing under surface. In fact, the Oxford series entirely supports Aurivillius' conclusions. There is no doubt that the four types of Kirby are a single species, and that all the Oni males are *limbata* (a synonym of *tenera*), while all the females but one are the *similis* ♀ form of *tenera*, the exception approaching the *tenera* ♀ form.

When a long series of males and females of *Citrinophila tenera* are compared together certain extremely interesting differences are revealed. In the females the orange ground-colour is paler and yellower, the black margin of the fore-wing upper surface does not extend along the basal section of the costa (noted by Eltringham in "African Mimetic

Butterflies," Oxford, 1910, p. 89), and the black margin of the hind-wing upper surface is narrower. In other words the differences are those commonly characteristic of the genus *Terias*, viz. of the Pierine models.

J. Röber in an article on mimicry (Entom. Mitteilungen, vol. x, nr. 1, Jan. 5, 1921, p. 23) disputes Doflein's conclusion (Hesse and Doflein "Tierbau und Tierleben," vol. ii, 1914, pl. ix) that *Terias* is the model of *Citrinophila*, because the special protection of *Terias* has not yet been proved, and because of the difference in size. But such a difference between model and mimic is common and unimportant; for, as Mr. F. A. Heron has pointed out, apparent size is determined by distance (Proc. Ent. Soc., 1903, pp. lxv, lxvi). Furthermore, the resemblance deceives the insects themselves; for one of the Oni males referred to on p. 465 was observed by Lamborn, on Aug. 5, 1910, to be eagerly pursuing a male of *Terias senegalensis* Boisd., and both were taken in a single sweep of the net. Although this *Terias* is not so good a model as *brigitta* the two insects would closely resemble each other on the wing. The correspondence between the patterns of the sexes referred to above supplies further evidence of mimetic association.

I have now had the opportunity of studying Doflein's plate, and find that the figures of *Citrinophila similis* and its model *Terias brigitta* Cram. are copied from Dr. Eltringham's work, published in 1910 (*ibid.*, p. 89, pl. ix. figs. 27 and 22, respectively).

Dr. Dixey has kindly written the following note on the mimicry of *Citrinophila tenera* :—

"Of the three common species of *Terias* which occur in the same locality as Mr. Lamborn's specimens of *Citrinophila tenera*, viz. *T. brigitta* Cram., *T. regularis* Butl., and *T. senegalensis* Boisd., the resemblance is closest to *T. brigitta*. The correspondence between the male Lycaenid and the male Pierid is remarkably exact; that between the respective females is also quite good, but in this latter case there are some interesting differences. The aspect of *T. brigitta* ♀ varies according to season, and the aspect of *C. tenera*, ♀ f. *similis* presents features which belong to the wet phase of *T. brigitta* ♀ together with some that are characteristic of the dry. The dark border to the hind-wing in the *similis* ♀ suggests the 'wet-season' phase of *T. brigitta* ♀, while the uniform

yellow of the ground-colour, and absence of dusky irroration, are marks of the 'dry-season' phase. The *tenera* ♀ on the other hand, with a greatly reduced hind-wing border, resembles the dry phase of the model in this as in the other respects. It appears, however, to be far less common than *similis*, at any rate in the Lagos district.

"It may perhaps be said that on a rapid glance an average *similis* ♀ of *C. tenera* would pass muster as either a 'dry' or a 'wet' *T. brigitta* ♀. The yellow of the female *Terias* is usually paler than that of the male at all seasons, and the yellow of the female Lycaenid tends similarly to be paler than that of the male, but to a less extent. The absence of the dark costal border to the fore-wing, passing inward from the dark apex, is characteristic of the female of both species. The yellow of *Citrinophila*, being slightly tinged with ochre, is hardly so brilliant as that of *Terias*, but there can be little doubt that it would be difficult to distinguish the two insects when flying, or even when settled.

"The upper surface of the yellow examples of the larger species of *Citrinophila* (*C. erastus* Hew., or probably a closely allied species or subspecies), captured by Lamborn at Oni, differs in size and shape and to some extent in colour from *C. tenera*. In all these respects it approaches the aspect of *Terias regularis* Butl., a near ally of *T. brigitta*. The under surface of this *Citrinophila* resembles, strongly in the female but less so in the male, a pattern common in the Pierine genus *Mylothris;* and the same is true of the upper surface as well as the under of the creamy white female of typical *erastus*, although the yellow upper surface of its male is mimetic of *Terias*. The resemblance of the white female to *Mylothris* was described by Eltringham in 1910 (*ibid.*, p. 90, pl. ix, fig. 30). See also Proc. Roy. Soc., B., vol. 91, 1920, pp. xxiv, xxv.

"The general resemblance of *Citrinophila* to *Terias* extends also to *T. senegalensis*, but is much less obvious in this case than in the other two.

"It is worthy of note that *Liptena flavicans* Sm. and Kirb., specimens of which are also in Mr. Lamborn's collection from Oni, at once recalls the dry-season female of *Terias brigitta*, though the brownish-ochreous hue of the former insect is dull in comparison with the clear yellow of the latter."

VII. *The polymorphic Females of Cymothoe theobene Dbl.-Hew. The Specimens captured, and Families bred from known Female Parents by W. A. Lamborn.* By Prof. Poulton.

It is exceedingly interesting that Farquharson should have repeated at Moor Plantation in 1915 the breeding experiments conducted by Lamborn at Oni, 70 miles E. of Lagos, in 1912. No account of these results or of Lamborn's captured specimens has hitherto appeared, and, inasmuch as they add another and very striking example to the list of butterflies with polymorphic females, I take this opportunity of describing them. The new female forms, which are very variable and are transitional into one another, may be grouped as follows :—

A. Lutescens, ♀ f. n.

The white median band of F. and H.W.s of the *theobene* ♀ is more or less invaded by orange, which also often appears around the blackish spots of the irregularly curved row distal to the band and around the spots of the submarginal lunulate line. The black-brown basal area of both wings also acquires a yellowish tinge, and, in the darker examples, the sharpness of its distal edge is obscured. The orange may perhaps be explained by transference from the male, but it is commonly accompanied by dark pigment, the two together producing an appearance altogether different from the *theobene* ♀. The *lutescens* form is transitional on one side into *theobene* and on the other, by increase in the dark pigment, into the following :—

B. Nigro-lutescens, ♀ f. n.

In this form the dark pigment tends completely to overspread the white area of *theobene*, in both wings. Combined with it the orange, becoming very faint in the darkest examples, occupies the positions described above. In spite of this increasing faintness accompanying

increasing darkness, the *nigrescens* forms, without the orange, are less dark than the majority of *nigro-lutescens*. The most extreme example of the latter (No. 8, p. 471) appears as an almost uniformly blackish butterfly with a faint yellow tinge in the region of the median band and one still fainter, indeed evanescent, in the more distal areas.*

C. Nigrescens, ♀ f. n.

In this form the dark pigment invades the white median band to a variable extent, in pronounced examples nearly obliterating it, in others replacing it by grey. In many specimens this invasion is strong in F.W., slight in H.W. As already stated, the pigment is less dark in this form than in *nigro-lutescens*, and the distal edge of the basal area and the spots of the curved and lunulate lines are more distinct than in any other form except *theobene* and the palest *lutescens*.

The under surface of the three forms usually differs but little from that of *theobene*. There is commonly an emphasis of the dark pigment, pronounced in the extreme forms, especially along the shadow-like outer border of the midrib-like stripe.

Lamborn's captured specimens, together with Farquharson's two bred varieties (p. 403), are arranged below, each set of forms in the order of increasing darkness.

* It is interesting to note that parallel female forms are found in the allied S. African *C. alcimeda* Godt., as recognised by Trimen in "South African Butterflies," 1887, i, p. 314. In a series of 4 ♂, 9 ♀ captured by the Rev. K. St. A. Rogers at Eland's Kop (about 5000 ft.), about 30 miles S.W. of Pieter Maritzburg, March 12–21, 1919, 6 ♀ have the median band of the creamy colour described by Trimen on p. 313 (where the sign ♀ is accidentally replaced by ♂). The tint is deeper in F.W., and in one example may be described as pale yellow—as also in a ♀ from Llabisa, E. Centr. Zululand. In the remaining three Eland's Kop ♀ the yellow tint is greatly deepened in both wings, being pale ochreous in one, deep ochreous in the second, and nearly obliterated by fuscous in the third. There is a less strong fuscous invasion of the band in the two former, and all three may be considered forms of *nigro-fulvescens*, the third being very near *nigrescens*. The Eland's Kop examples are small, the females varying from 52 to 56 mm. in expanse, the males from 46 to 52.—E. B. P.

1. *Lutescens* ♀ f. : Oni. May 25, 1910. Orange tinge faint.
2. ,, ,, ,, Oct. 11, 1910. (Type.) Capt. *in cop.*
3. ,, ,, ,, May 27, 1910.
4. ,, ,, ,, July 18, 1912.
5. *Nigro-lutescens* ♀ f. Bred by Farquharson (p. 403) at Moor Plantation, Aug. 21, 1915. (Type.)
6. ,, ,, Oni. Aug. 7, 1910.
7. ,, ,, Oni. Dec. 1, 1908–Dec. 3, 1909.
8. ,, ,, Bred by Farquharson (p. 403) at Moor Plantation, Aug. 4, 1915. By far the darkest form with much the strongest "shadow" to midrib stripe on underside.

Then follow the *nigrescens* ♀ forms in the order of increasing darkness, but it must be remembered, much less dark than the majority of *nigro-lutescens*.

9. *Nigrescens* ♀ f. : Oni. Emerged Mar. 24, 1911, from pupa found Mar. 23. (Type.) Median band grey in F.W. nearly white in H.W.
10. ,, ,, ,, April 25, 1910. On black sticky exudation fallen from tree. Median band grey in both F. and H.W. Strong "shadow" to midrib stripe on underside.

All three forms fly with *theobene*, and there is no evidence of any local or seasonal difference between them. Thus half the individuals of the above list were taken in the forest up to a mile to the E. of Oni in 1910, while 7 examples of the *theobene* ♀ were captured in the same area between April 16 and June 5 of the same year. On May 25 and again on May 27 a *lutescens* (Nos. 1 and 3 respectively) was taken with a *theobene*. The wet season in 1910 had well set in by about April 25.

The table on p. 472 shows clearly the results obtained by Lamborn in his three breeding experiments; and here too in Fams. B and C, as well as in Farquharson's (p. 403), the *theobene* ♀ appears with one or more of the new forms.

Mendelian heredity is suggested by Fam. A, where all the female offspring are of the same form and all different from the female parent. It is to be hoped that breeding experiments may be repeated and carried far enough to test this suggestion. Considering the rarity of these new forms in collections it is remarkable that so many should have appeared in the four families recorded here and on p. 403.

Oni, 70 m. E. of Lagos: 1912.	Date of pupation.	Date of emergence.	Males	Females. *Theobene.*	Females. *Lutescens.*	Females. *Nigro-lutescens.*	Females. *Nigrescens.*	Remarks.
Family A, from ♀ parent (No. 767), *a worn lutescens f. like* (1) *but orange stronger in H.W. median band*; capt. in forest, 1 m. E. of Oni, Apr. 11; ova laid Apr. 13–17; died Apr. 19.	Apr. 27	May 4	1					
	,, 27	,, 5	2					
	,, 28	,, 5	3				3	♀♀ similar to type.
	,, 29	,, 6	2				2	,, ,, ,, ,,
	,, 30	,, 7					3	2 ♀♀ ,, ,, 1 w. darker H.W., like (10).
	TOTALS . .		8				8	
Family B, from ♀ parent (No. 768), *a typical theobene form*; capt. in forest 1½ m. E. of Oni, Apr. 13; ova laid Apr. 13–15; died Apr. 18.	Apr. 27	May 5	1					
	,, 28	,, 5	5			1		♀ slightly darker than type.
	,, 29	,, 6	3	1				
	,, 29	,, 7		1			1	♀ *nigrescens*, a dark var.
	,, 30	,, 7	1					
	TOTALS . .		10	2		1	1	
Family C, from ♀ parent (No. 771), *injured before capt., but probably a pale nigrescens f.*;* capt. in forest 1½ m. E. of Oni, Apr. 13; ova laid Apr. 13–14; died Apr. 15.	Apr. 28	May 6	1					
	,, 29	,, 6	3	1				♀ trans. towards *lutescens*.
	,, 30	,, 7	1					
	May 1	,, 8	2					
	,, 2	,, 9				1		♀ similar to type but brighter orange.
	No record.	,, 9		1			1	♀ *nigrescens*, a dark var.
	TOTALS . .		7	2		1	1	

* Very worn and the H.W.s nearly gone. Apparently a *nigrescens* f., very pale in the F.W.s, darker in the H.

VIII. *On the Larvae and Pupae of Lepidoptera, chiefly Lycaenidae, collected by C. O. Farquharson, W. A. Lamborn, and the Rev. Canon K. St. A. Rogers.* By Harry Eltringham, M.A., D.Sc.

Plates XII, XIII. Text Figures 4, 5.

The accompanying figures of larvae and pupae have been drawn from examples in the Hope Department at Oxford. The acquisition of Farquharson's specimens provided an opportunity of reviewing the whole of the material at our disposal, including the valuable contributions received from Mr. Lamborn and the Rev. Canon K. St. A. Rogers. It must be understood that as regards the pupae, in nearly every case the cuticle only has been available, the imago having emerged. The drawings are thus in the nature of restorations, and slight errors of shape may have occurred in those which were in a less perfect condition. The original colours have not been preserved and it is only possible to refer to the markings as light or dark, except in a few cases where they are described in the collector's letters.

a. Lipteninae.

Aslauga lamborni Bethune-Baker. Plate XII, figs. 4, 5.

Pupa. (Fig. 5.) A small much-contracted pupa attached by posterior extremity to a leaf, with the ventral surface in contact with the support. Chiefly remarkable for the presence on the pupa of chitinous growths of very remarkable formation. Such growths in one form or another are found on many Lycaenid larvae and pupae. They are of the same nature as the interlocking plates forming the armour of the larva of *Euliphyra mirifica* described by me, Trans. Ent. Soc. 1913, p. 509. As they are so marked a feature in Lycaenidae, and their structure is in many cases so elaborate, I propose the name *chitinanth*, a word kindly given me by Prof. Gilbert Murray to whom Prof. Poulton referred the matter. The meaning is of course "chitin flower" and is singularly appropriate. In the present species comparatively few remain on the pupa, but from an examination of the larval skin, it would appear that the larva itself is entirely covered with them.

One of the structures highly magnified is shown at Fig. 4. Length of pupa 8 mm. Lamborn, Oni. A ♀ emerged 3.2.12.

Euliphyra mirifica Holl. Plate XIII, fig. 3.

In an appendix to Mr. Lamborn's paper in our Transactions of 1913, I described (p. 509) the larva of this species, and the material then at my disposal suggested that the pupa was always partly enclosed in the old larval skin. (That of the Australian *Liphyra brassolis* Westw. is completely so enclosed, the larval skin forming a kind of puparium.) Further material shows that in this case the larval skin is not always, perhaps not generally, retained, since several examples are entirely without it. The pupa is attached by a sucker-like expansion of the terminal segments, and a depression of the abdominal segments forms a deep dorsal furrow. Its support is a leaf. On the thoracic region is a central ridge from which smaller ridges extend at right angles. The cuticle, especially of the abdominal region, is much folded and shrivelled. Length 19 mm. Lamborn, Oni. June–July 1912.

Epitola hewitsoni Mab. Plate XII, fig. 1.

Pupa. This remarkable pupa is attached by the terminal segments to its support and stands nearly at right angles thereto. Round the point of attachment are found remains of the larval skin, which was evidently clothed with long spines. The wing-cases have a beautifully marbled pattern, whilst the remainder of the cuticle bears dark irregular markings. The head has a blunt horn-like projection, the thorax has two prominent dorsal ridges, and there are large prominences on some of the abdominal segments. Scattered over the head and thoracic region and on various points of the abdomen are rounded tubercles from which arise thick curved spines. In nature the pupa is evidently extremely cryptic, its grotesque form doubtless serving to hide its outline more or less completely. Length 20 mm. Lamborn, Oni. 19.4.1910.

Epitola ceraunia Hew. Plate XII, fig. 3.

Pupa. A very pale pupa with a few black markings, notably on the wing-cases and the dorsal and lateral regions. The smooth prominent tubercles, which in the dry specimens are orange brown, form the most characteristic feature. From each of these projects a blunt spine. The greater part of the dorsal thoracic and abdominal areas sparsely set with very minute spines or setae. Pupa

attached posteriorly to a leaf. The larval hairs combined with those of the posterior pupal segments are attached to the leaf in radiate formation. Length 15 mm. Lamborn, Oni. Emerged 22.2.12.

Epitola miranda Staud.

Pupa. I have not figured this pupa since it so closely resembles that of *E. ceraunia* that a separate illustration seems unnecessary. It is attached by the terminal segments, which are themselves clothed with long white hairs, resting on a cushion formed from the old larval skin. The long axis of the pupa is at right angles to the plane of its support. The dark markings are less irregular than in *ceraunia*. The 2nd abdominal segment bears a black, bracket-shaped transverse streak. On lateral prominences of the abdominal segments are a few very small chitinanths, and from these prominences on the 2nd, 3rd and 4th segments, there arise long fine bristles, which instead of projecting, are curved round the wing-cases. This feature is not shared by the pupa of *ceraunia*. Length 15 mm. Lamborn, Moor Plantation. Emerged 6.11.13.

Epitola concepcion Suff. Plate XII, fig. 13.

Pupa. Very pale with a few dark markings as shown in the figure. Small lateral clusters of delicate hairs, and on head, thorax, and abdomen, tufts of long chitinous processes having flattened dentate extremities. A few short setae scattered sparsely over the cuticle, and much longer ones projecting from the terminal segments. Length 12 mm. The example figured produced a male which emerged 2.11.13. Lamborn, Moor Plantation.

Epitola honorius Fab. Plate XII, figs. 16, 17.

Larva. (Fig. 17.) Medium dark ground-colour with still darker markings forming a rather complicated pattern. (Farquharson describes the general colour as brown.) Each segment with four tubercles from which arise tufts of fine sharp spines, and also longer delicate branched hairs. The whole cuticle is sparsely covered with fine short hairs. Length 16 mm. Farquharson, Shagamu. 8.9.15.

Pupa. (Fig. 16.) Of the shape and appearance shown in the figure. A prominent and characteristic dark marking

on the thorax. Dorsal and lateral tubercles from which arise irregularly curved spines. Abdominal segments bear groups of chitinanths, each being surrounded by a dark ring on the cuticle. Dense hairs on the terminal segments combine with those of the larval skin to form a cushion round the point of attachment, the pupa lying nearly parallel to its support. Length 15 mm. Farquharson, Shagamu. Emerged 19.9.15.

Epitola ? sp. Plate XII, fig. 12.

Pupa. A small pupa the imago from which has not yet been identified. Dorsally the head bears two rather deep depressions, and the thoracic region is rounded and resembles a breastplate. Ground-colour very pale. A few slender black markings as figured. Numerous lateral tufts of chitinous projections gradually thickened towards their outer extremities, and having a dentate surface. Thoracic and abdominal surfaces sparsely clothed with very minute setae. A few longer setae projecting from the terminal segments. Length 12 mm. Lamborn, Moor Plantation. 6.11.13.

Epitola carcina Hew. Plate XII, fig. 18.

Pupa. Characteristically marked on thorax as shown in figure. The general surface sparsely clothed with fine setae. On thorax and abdomen tufts of short sharp spines, and on head, thorax, and abdomen lateral and dorsal groups of delicate chitinous projections which are white with black tips. Attached to leaf by terminal segments and lying nearly parallel to its support. Length 10 mm. The example figured produced a male, which emerged 8.2.12. Pupa, Lamborn, Oni. 7.2.12.

Teratoneura isabellae Dudgeon. Plate XII, figs. 7–9, 14, 15.

The general appearance of a dorsal view of the larva is shown at fig. 8. On each segment there are lateral and dorsal rows of tubercles from each of which arises a tuft of long fine hairs having the structure shown at fig. 15. The head and terminal segments are black, the former with a central pale streak flanked by two large pale spots. On segments 5 to 8 inclusive are dorso-laterally placed dark patches which consist of masses of urticating spicules. These are of the form shown at fig. 7. They are all slightly

curved, but whether this is natural or due to the immersion in the preservative fluid cannot at present be decided. The whole larva has a very "Lymantrid" appearance, and the presence of urticating spicules on a Rhopalocerous larva is a very remarkable feature. Farquharson describes the larva as brightly pigmented with red, green, and yellow, and perhaps other colours, such as one associates with Lymantrid caterpillars. Length of larva 18 mm. Farquharson, Moor Plantation.

Pupa. The extraordinary pupa, shown at fig. 9, is attached by the terminal segments to its support, and the remains of the larval skin form a cushion of radiating hairs. On the 5th and 6th abdominal segments there is a conspicuous dorsal patch of yellowish brown, and a similar one just behind the head. The whole thoracic and dorsal surfaces are densely covered with elaborate chitinanths, which in many places are white. The effect of this is very peculiar. It gives the pupa the appearance of being mouldy, a fact to which I called attention before I knew that Farquharson had observed the same appearance in nature (p. 340.) Until I examined the pupa microscopically I quite thought it was mould, and that the specimens would have to be cleaned. In addition to the general covering by these structures, there arise from various points long branched filamentous chitinanths as shown in the figure. These add to the mouldy appearance. Length 15 mm. ♂ emerged 9.12.17, at Agege, larva from Moor Plantation, Ibadan. C. O. Farquharson.

Iridopsis incredibilis Staud. Plate XII, figs. 6, 10.

Pupa. As will be seen from fig. 10, the shape of this pupa is quite unusual, its form gradually widening from the posterior to the anterior end. The cuticle is covered with chitinanths both stellate and annular, and also with long delicate filaments bearing plume-like expansions at their extremities. A small portion of the cuticle is shown at fig. 6 highly magnified. From the terminal extremities project tufts of long hairs which blend with those of the larval skin, forming a dense cushion at the point of attachment. The pupa lies flat with the ventral surface in contact with the bark. The larva was evidently clothed with silky hairs. There is a considerable quantity of silk on the bark, round the pupa, forming a kind of elementary cocoon. Length 12 mm. The example figured produced

a male which emerged 30.9.15. Farquharson, Moor Plantation.

Citrinophila tenera Kirby. Plate XII, fig. 11.

Pupa. This little pupa was attached to bark of the Pará Rubber tree on which it lay with the ventral surface in contact. The thoracic region, which is dark in colour, bears a prominent dorsal ridge, and along the whole length of the pupa are dorso-lateral prominences from which arise long branched hairs. The still longer hairs of the larval skin radiate in masses from the point of attachment. The general appearance is extremely cryptic. Length 7 mm. Farquharson, Agege. 18.10.17.

Hewitsonia similis Auriv. Plate XII, fig. 2.

Pupa. Ground-colour very pale with some very small black markings on wing-cases and black-and-white dots on the remainder of the cuticle. A darker " arrow head " pattern on the dorsal thoracic region. The black-and-white dots are really chitinanths of simple structure, flat and of reniform outline. From various points of the cuticle arise long needle-like spines, some of which are black and some white. The lateral portions of the abdominal segments are flattened and expanded, and the last four segments are separated from the rest by a constriction. The general appearance reminds one of some large species of Coccid. It is attached terminally to a piece of bark and lies flat upon it. Remains of the larval skin show it to have been clothed with long fine branched hairs. Length 17 mm. Lamborn, Moor Plantation. Emerged 28.11.13.

b. Lycaeninae.

Tanuetheira timon F. Plate XIII, figs. 5, 7, 11.

Larva. The drawing reproduced in fig. 7 must be regarded as to some extent diagrammatic, since from Farquharson's notes it seems doubtful whether the head and legs are in life so prominently displayed as in the sketch. The colour is described as " dull green," like the larva of *A. paneperata*. The larva may be described as onisciform, the dorsal portion forming a ridge segmentally divided into stiff plates, the upper edges of which are projected backwards so as

slightly to overlap. Anteriorly these plates form projections round a deep cavity the general arrangement of which can best be understood from the figure. The head in the preserved example is pointed vertically downwards, though this is probably not a natural position. The lateral parts of the segments form a kind of mantle which, when in close contact with the support, completely covers and protects the head, legs, and ventral surface. The last segment is prolonged into a bifid process. The larval cuticle is of comparatively enormous thickness and consists of a dense fibrous tissue carrying dorsally a number of small hooked spines. The surface of the cuticle, fig. 11, shows, under a medium magnification, a delicate tracery having a squamoid pattern, and fairly evenly distributed upon it are great numbers of chitinanths, resembling in shape single roses, in many cases bearing a partially or completely expanded chitinous tuft. As the tufts are easily broken it seems probable that normally they are always formed, and that where only the rose formation remains they have become detached. Length 16 mm. Farquharson, Moor Plantation. Dec. 1917–Feb. 1918.

Pupa. The pupa is shown, not quite complete at fig. 5. It is difficult in a mere black-and-white sketch to suggest its extraordinary resemblance to a bud. The terminal segments are progressively tapered towards the point of attachment, and the long axis of the pupa forms a sinuous curve giving it a most characteristic shape. Judging from the appearance of the dry skin, the original colour is green, somewhat darker towards the point of attachment. The central portion of the dorsal surface is also darker, as are the wing-cases, thus giving the lateral parts a close resemblance to the green part of the expanding bud. Length about 15 mm. Farquharson, Moor Plantation. Jan.–Feb. 1918.

Argiolaus paneperata H. H. Druce. Plate XIII, figs. 9, 18.

Larva. Fig. 9 shows the larva with head and feet retracted. It is really rather similar to that of the previous species, but differs in the much simpler structure of the anterior segments. Farquharson describes the colour as "a sort of mistletoe-leaf green," exactly resembling the immature flowers which are "dull green—a sort of bud-scale green shot with brownish hairs" (pp. 368, 372). The

cuticle, a surface view of which is shown at fig. 18, has the same squamoid markings, but the chitinanths are of a different type, being merely tufts without the elaborations shown in *timon*.

Pupa. All the pupa skins are much shrivelled, but it is evident that the abdominal segments differ from those of *timon* in being less rounded, and so forming a marked dorsal angle. The whole effect is less bud-like, and the pupa seems generally to be attached to a leaf instead of to a stem. The cuticle is smooth. Length 15 mm. Farquharson, Moor Plantation. Jan.–Feb. 1918.

Argiolaus iulus Hew. Plate XIII, fig. 4.

Pupa. The general shape of this pupa recalls that of *T. timon*, being somewhat bud-like, though it would appear usually to be attached to a leaf. The terminal segments are very narrow suggesting a stalk, and the last, though but little expanded, has the sucker-like formation noted in several other species. The dorsal area is covered with punctulations, and a very conspicuous feature is the presence on the fourth and fifth abdominal segments of two large yellow patches outlined in black. The thoracic portion of the skin is in all the specimens too distorted for accurate representation. It is noticeable that the pupa of *iulus* bears a greater resemblance to that of *T. timon* than to those of other species of its own genus. The example shown produced a male which emerged 25.2.17. Length of pupa 15 mm. Farquharson, Moor Plantation.

Argiolaus alcibiades Kirby. Plate XIII, fig. 2.

Pupa. This pupa does not present any very marked features of interest. As the figure shows, the dorsal aspect is somewhat coffin-shaped and the cuticle is finely granulated. Attached to support by a sucker-like expansion of the terminal segment. It is described as "apple or Alga green—not shining but dull green like the surface of a tomentose leaf." Length 18 mm. The example shown produced a female which emerged 23.1.18. Farquharson, Moor Plantation.

Argiolaus ? sp. (nr. **silarus** H. H. Druce). Plate XIII, fig. 1.

The pupa figured is somewhat like that of *iulus*, but the dorsal markings are more extensive and elaborate. The surface is comparatively smooth and in the dried specimen

the ground-colour is deep ochreous with the markings in brown. In life they are described by the Rev. Canon K. St. Aubyn Rogers as fairly bright green, the variable dark markings having paler centres. A single pupa was purplish brown. There are three examples, all attached to *Loranthus* leaves. Two were taken by Canon Rogers and bear the label "Kongwa, Tanganyika Territory, 1917," and one by Lamborn labelled "Tanga, 1917." Length 15 mm.

Argiolaus maesa Hew. Plate XIII, fig. 17.

This pupa bears a remarkable resemblance to a gall, and is attached to a leaf by a sucker-like expansion of the terminal segment. The remaining abdominal segments are rounded and swollen and bear two very conspicuous black depressions in the dorsal line, suggesting the openings from which the gall insects have emerged. Judging from the faded colour of the pupa case the posterior part is green, matching the support. The cuticle is devoid of hairs, but is finely punctulated and bears a few slight projections. The gall-like appearance in life must be extraordinarily close, for Lamborn described in a letter from Moor Plantation, September 30, 1913, how he had shown, first a Liptenine pupa and then one of *A. measa* on its leaf, to Farquharson, who made out the first but examined the second "in a casual way, remarking, 'A beautiful gall! Something has evidently come out of it.'" The two dorsal marks had also previously suggested to Lamborn that some insect had emerged. The pupa of *maesa* was then taken to another scientific friend who said, "'A gall, isn't it?' his manner suggesting that he rather wondered at being shown such an ordinary thing." Length 13 mm. From the example figured an ichneumon emerged 26.12.13. Lamborn, Moor Plantation.

Epamera laon Hew. Plate XIII, fig. 15.

Pupa. The abdominal segments are much rounded, resembling the previous species. The thoracic portion is ridged and angulated and the whole cuticle is punctulated and bears numerous ridges and prominences. It is especially to be noted that the pupa in its natural position is placed with its long axis nearly at right angles to the stem to which it is attached, as in the case of *Epamera farquharsoni*. Farquharson describes the larva of this species

as dark mole-colour with one or two tiny white and brown spots posteriorly. It is very cryptic and, except in colour, resembles that of *Epamera farquharsoni*. The example figured produced a male which emerged 2.3.12. Length 11 mm. Lamborn, Oni.

Epamera farquharsoni Beth.-Bak. Plate XIII, figs. 6, 10, 12.

Larva (fig. 6). This larva is described as "wonderfully cryptic" and is of a green colour with tiny points of brown or red. I have drawn it from the dorsal aspect, as that point of view seems best to illustrate the very remarkable "mantle edge" or fringe of processes, which evidently enable the insect to blend so perfectly with the surface on which it is resting as to make it practically indistinguishable. These processes are extensions of the thick fibrous cuticle and their irregular outline adds greatly to their efficacy. The dorsal part of the larva is not ridged, but rounded, its regularity broken by small raised processes as shown in the figure. Farquharson records how, having found one of these larvae, he immediately afterwards cut another in two before realising its presence (p. 368). The cuticle (fig. 12) differs considerably from that of *timon* and *paneperata*. It does not show the squamoid surface, and the chitinanths, though somewhat resembling those of *paneperata*, are nevertheless quite distinct. Length of larva 18 mm. Farquharson. Moor Plantation, Jan. 1918.

Pupa. Fig. 10 shows one of the pupa-cases in its natural position just above a flower cushion of the *Loranthus*. It is placed with its long axis at right angles to that of the stem, and in nature is probably far less conspicuous than it appears in the drawing. The pupa is very short, the abdominal segments well rounded, and projecting high above those of the thorax. The whole surface is rough and irregular with occasional smoothly rounded tubercles. On the 1st abdominal segment is a slight concavity very darkly coloured and having the appearance of a hole. The mark is nearly round, but appears slightly elongated in the drawing owing to the foreshortening. There is a smaller more rudimentary mark on the next segment. These marks produce an effect which is much more highly elaborated in the "gall" pupa already described. Length 12 mm. Farquharson, Moor Plantation. Jan. 1918.

Hypokopelates nigra Beth.-Bak. Plate XIII, fig. 19.

Pupa. The pupa is attached along its ventral surface to the underside of a leaf and resembles somewhat that of *Pilodeudorix diyllus* (fig. 8), and is darkly marbled on a slightly paler ground-colour. The cuticle is smooth, but bears numerous very minute hairs. A portion of the larval skin remains attached to the leaf, and from this I have made a preparation which shows the larval cuticle to be covered with chitinanths of the forms shown at fig. 19. Length of pupa 10 mm. From the example figured the male type emerged 16.5.12. Lamborn, Oni.

Lachnocnema bibulus F. Plate XIII, fig. 21.

Pupa. The cuticle of the abdominal segments is thrown into a multiplicity of folds, giving it a very rough appearance, and the peculiar structure of the terminal segments is shown in the figure. At the head are two processes, and the thoracic portion is wavy and irregular. The example shown produced a male, which emerged 1.12.13. Length of pupa 10 mm. Lamborn, Moor Plantation.

Lycaenesthes liodes Hew. Plate XIII, fig. 20.

This small pupa calls for little remark. Its general appearance is shown by the figure, and the cuticle is smooth and bears a sparse but regular covering of very minute hairs. The example shown produced a male which emerged 10.12.13. Length 10 mm. Lamborn, Moor Plantation.

Zeltus sp. ? **lebona** Hew. Plate XIII, fig. 16.

A small perfectly smooth pupa, pale in colour with slightly darker markings. Length 6 mm. Emerged 27.1.12. Lamborn, Oni.

Megalopalpus zymna Hew. Plate XIII, fig. 13.

This curious pupa is remarkable for its elongated form and absence of irregular projections. It is ornamented all over with dark markings which give it a delicately marbled appearance, and on the abdominal segments are smooth rounded processes. It is attached by the terminal segment, its long axis making a slight angle with that of the twig. Length 7·5 mm. Emerged 25.2.12. Lamborn, Oni.

Pilodeudorix diyllus Hew. Plate XIII, figs. 8, 14.

Larva (fig. 14). The colour of the preserved example is fairly uniform and rather dark. The 1st segment is rounded and covers the head, the remainder, to the 9th, present lateral blunt processes and a double row of dorsal projections. The last three segments are of somewhat peculiar shape, as shown in the drawing. The whole surface is covered with fine short spines. Length 14 mm.

Pupa (fig. 8). Attached so that the ventral surface is in contact with the support. The cuticle is smooth and, except for the wing-cases, has a sparse coating of very minute hairs. The dried example is dark brown marbled all over with black. The general shape is shown by the figure. Length 11 mm. The example figured produced a male 13.3.17. Farquharson, Moor Plantation.

c. Note on the Presence of Guenée's Gland.

With regard to the presence or absence of a honey-gland in the larvae of this series which I have examined, there is in that of *Argiolaus paneperata* a slightly paler mark on the 7th abdominal segment, and the distinct appearance of a slit. Lamborn (Trans. Ent. Soc. 1913, p. 475) records the presence of a dorsal gland in the larva of *Argiolaus iulus*. I have not found a similar structure in the larva of *Tanuetheira timon* or in that of *Epamera farquharsoni*, though it might well be hidden by the chitinanths which abound on the cuticle of these species. In the case of *Teratoneura isabellae* and *Epitola honorius* there are so many lines and markings on the cuticle that the presence of the slit would probably be effectively disguised. It would seem very probable that the long and numerous hairs on these larvae are hardly consistent with the presence of active honey-glands. In *Pilodeudorix diyllus* I have not found any outward sign of the presence of the gland. (See, however, pp. 382–83, almost certainly referring to these, by far the commonest *Pterocarpus* Lycaenid larvae).

d. On the "Electric" Sensation caused by Lycaenid Larvae.

One of the most interesting of the late Mr. Farquharson's observations is the suggestion that some of his "Loranthus" larvae, and especially that of *Tanuetheira timon*, are capable

of giving a mild electric discharge (see p. 376). It is most unfortunate that further and more precise experiments were not made with these larvae, such as contact with an electroscope or voltmeter. A shock such as could be felt by the human hand would necessarily be of considerable electrical pressure, and for so great a discharge from creatures so small as the larvae in question, some elaborate development of electroplaxes would be expected. I have made numerous sections of the larvae, and at first, not being familiar with the immensely thick fibrous cuticle possessed by them, I was inclined to suppose that, in spite of its lack of resemblance to known forms of electric tissue, this unusual structure might be the source of the phenomenon. Comparison with some of our native species showed, however, that this special cuticle was not peculiar to the supposed electric larva. Our own Lycaenid larvae such as *betulae* and *quercus* are similarly endowed, though they do not appear to afford any electric manifestations. The cuticle of the larva of *timon* is extremely rough and would therefore cause considerable friction between itself and the human skin. In view of this it appeared to me that if the larva were capable of producing, when handled, extremely rapid muscular contractions or vibrations, an effect such as that described might well be produced on the delicate tactile nerve-endings of the human skin. After theorising in this way, I had the opportunity last spring of examining some larvae of *T. pruni*, which in general appearance are not unlike those of *timon*. I was examining one of them under the stereoscopic microscope when I was interested to note that it did in fact "shiver" at short intervals. The movement was not sufficiently rapid to produce an electrical sensation, but it at least demonstrated that such muscular vibrations are possible. I do not wish to convey the impression that the electrical theory is necessarily erroneous, but in the absence of tissue having any resemblance to known forms of electroplax, other possibilities should have due consideration. The yellowish points which Farquharson regarded as the centres of the discharge are almost certainly the chitinanths already described.

e. On the Prolegs of Lycaenidae.

On the figure of the larva of *Tanuetheira timon*, Pl. XIII, fig. 7, small processes may be observed on the prolegs.

Similar structures are found * on the prolegs of *Teratoneura isabellae*, and one of these is illustrated on a larger scale on Pl. XII, fig. 14. They consist of small diverticula of the cuticle, extensible by internal fluid pressure. We have discussed these structures with Dr. T. A. Chapman, F.R.S., who has given us much valuable information on the subject. In most Microlepidoptera there is on the prolegs a complete circle of hooks, whilst in most Macrolepidoptera half the circle has become atrophied. Dr. Chapman states that he formerly expressed the opinion that it was the outer half of the circle which had been preserved and the inner half lost. He now considers that the reverse is the case and

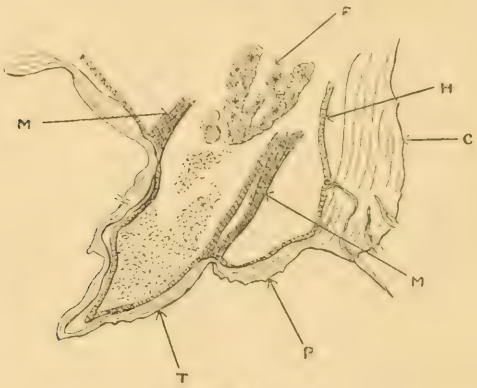


Fig. 4.

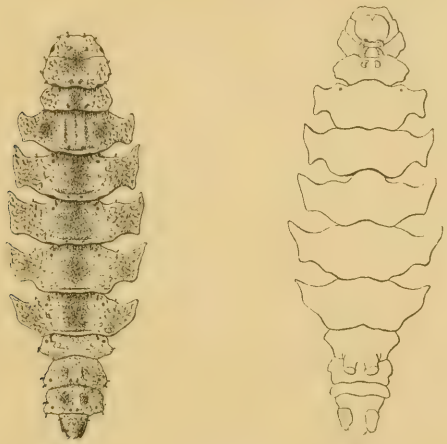
that in those species in which but half the circle of hooks remains, it is the inner half which persists. Now within this circle of hooks there is a kind of pad which can be protruded or withdrawn. This action gives to the hooks a rocking motion by which they engage and disengage with the surface on which the larva is progressing. There can be but little doubt that the papillae observed in many Lycaenid larvae are really developments of the centre of the extensible pad, and that they assist the larva by adhesive or tactile functions, or perhaps both. On this point see Farquharson's account on pp. 352, etc. That this is almost certainly the correct interpretation of the development of the papilla is shown by text fig. 4, which is a section

* Some of the detail of the original drawings has been lost in reproduction. Most of the figures will, however, bear examination with a low-power hand lens.

of the structure as found in *Callophrys rubi*. T is the papilla, P the position of the surviving hooks of the proleg, M is the muscular tissue, F the fat body, H the hypoderm, and C the cuticle. It will be seen that the papilla is not a separate organ, but is, as already indicated, a diverticulum of the cuticle. Incidentally the section supports the view that it is the inner half of the hooks which persists.

f. Note on a Remarkable Geometrid Larva.

Amongst the specimens sent home by Mr. Farquharson is a Geometrid larva which he describes as having the appearance of a small centipede. Unfortunately it was



A B

Fig. 5.

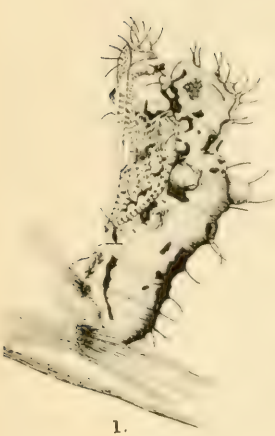
not on its food-plant and was the only example found by him, so that there is no means of identifying the species. The example I have figured is about 15 mm. in length. It was evidently undergoing a moult as parts of the old cuticle became detached on touching it. Text fig. 5, A shows a dorsal view. The first two segments are expanded and flattened, fused together, and dorsally slightly concave. They completely hide the head, at the same time forming a false head, the effect being much enhanced by the first pair of spiracles, which are black and so placed as to resemble eyes. The 3rd segment is more or less normal, but the 4th to 8th inclusive have large lateral expansions. The

spiracles of the 1st abdominal segment are completely displaced and appear on the underside. The 6th, 7th, and 8th abdominal segments are reduced in width, and the 9th and 10th more or less fused together. The whole cuticle is very rough and covered with minute wart-like protuberances in masses of ochreous and dark brown which produce a marbled effect. One of the many surprising features of the larva is the presence at many points of chitinanths, resembling those hitherto only found in Lycaenid larvae. At text fig. 5, B is a diagrammatic drawing of the underside to show the position of the true head, the first pair of spiracles, and the usual Geometrid prolegs. Farquharson refers to the larva as a "looper," so that we may assume that when alive it adopted that familiar method of progression. Mr. Prout has kindly examined the drawings of the larva and thinks it is certainly a Geometrid "perhaps an Emerald." I am indebted to Sir Geo. Hampson for reference to another Geometrid larva with which it may be compared. It is that of *Uliocnemis cassidara* Guén. (= *Comibaena biplagiata*) and is illustrated in Hampson, Ill. Het. IX (p. 145), Pl. 176, fig. 18, from a drawing by Mr. E. E. Green. It is described as yellowish drab, sides of the somites produced into fleshy processes on which the larva fastens small pieces of withered leaves and stick, as a disguise. It rests with the thoracic somites doubled under the body. Ceylon.

In this case the processes are not flattened but are in the form of tubercles. The appearance of the resting larva in its curious attitude and with its decoration of particles of dead leaf is very peculiar and evidently highly protective. Farquharson's larva was found at Agege, Oct. 18th, 1917.

g. On the Cocoon of Chionema farquharsoni B.-B.

The single example of this new species of Lithosid moth emerged from a pupa enclosed in a remarkable cocoon. The latter consists of an extremely thin silken bag covered all over with what are evidently the larval hairs. Each of these consists of a central stalk covered with innumerable fine branches, and each hair is attached to the cocoon by one end, so that all radiate from the centre, the result being a regularly constructed ball of mouse-coloured down. (See also p. 464.) Farquharson, Moor Plantation. 1916–1917.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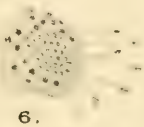
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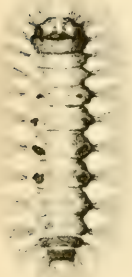
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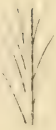
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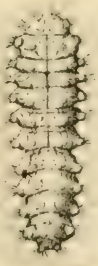
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LYCAENID LARVAE AND PUPAE.

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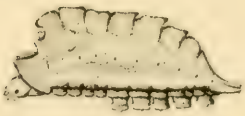
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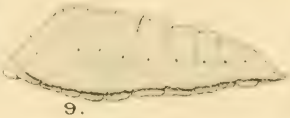
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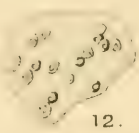
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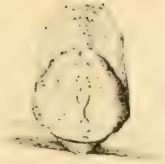
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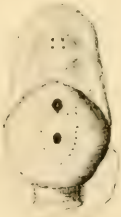
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LYCAENID LARVAE AND PUPAE.

Explanation of Plate XII.

Lipteninae.

Fig. 1. *Epitola hewitsoni*, pupa.
2. *Hewitsonia similis*, pupa.
3. *Epitola ceraunia*, pupa.
4. *Aslauga lamborni*, a chitinanth.
5. ,, ,, pupa.
6. *Iridopsis incredibilis*, part of pupal skin.
7. *Teratoneura isabellae*, one of the urticating spicules.
8. ,, ,, larva.
9. ,, ,, pupa.
10. *Iridopsis incredibilis*, pupa.
11. *Citrinophila tenera*, pupa.
12. *Epitola* sp., pupa.
13. ,, *concepcion*, pupa.
14. *Teratoneura isabellae*, proleg with papilla.
15. ,, ,, part of one of the long hairs of larva.
16. *Epitola honorius*, pupa.
17. ,, ,, larva.
18. ,, *carcina*, pupa.

Explanation of Plate XIII.

Lycaeninae (except Fig. 3).

Fig. 1. *Argiolaus* sp. near *silarus*, pupa.
2. ,, *alcibiades*, pupa.
3. *Euliphyra mirifica*, pupa.
4. *Argiolaus iulus*, pupa.
5. *Tanuetheira timon*, pupa.
6. *Epamera farquharsoni*, larva.
7. *Tanuetheira timon*, larva.
8. *Pilodeudorix diyllus*, pupa.
9. *Argiolaus paneperata*, larva.
10. *Epamera farquharsoni*, pupa.
11. *Tanuetheira timon*, part of larval skin with chitinanths.
12. *Epamera farquharsoni*, part of larval skin with chitinanths.
13. *Megalopalpus zymna*, pupa.
14. *Pilodeudorix diyllus*, larva.
15. *Epamera laon*, pupa.
16. *Zeltus? lebona*, pupa.
17. *Argiolaus maesa*, pupa.
18. ,, *paneperata*, part of larval skin with chitinanths.
19. *Hypokopelates nigra*, larval chitinanths.
20. *Lycaenesthes liodes*, pupa.
21. *Lachnocnema bibulus*, pupa.

IX. *The mature Larva and Pupa of Catochrysops phasma Butl.* (*Lycaeninae*). By Dr. T. A. Chapman, M.D., F.R.S.

The larva preserved in spirit of *C. phasma* has the colourless aspect of a hidden feeder (like *Lycaena arion* L., which is pale flesh-colour). Length 14 mm.; width mesothorax —4·5; 4th abdominal segment—5·0; 7th abdominal—4·5. Has the appearance of being distended, with segments approximately circular in transverse section. Ventral surface straight from 2nd thoracic to posterior end; prothorax a little projecting ventrally and head (on a neck) projecting ventrally 1·3 mm. Dorsum is curved, from front of prothorax, which is a little below the ventral line (of median segments), rising quickly over prothorax, then in a regular sweep, highest, of course, over 4th abdominal segment, with quite a hump over honey-gland and then sloping to end of 10th abdominal, which projects 0·6 mm. behind claspers which are placed nearly 1 mm. from the margin of segment towards the mid-ventral line.

The hinder portion of left side is darkened by some disease or *post mortem* change; the rest is of a very pale flesh tint, which may, of course, be lighter or darker than that during life. There are small brownish patches a little way above prolegs (not quite a third of the way to spiracles): these brownish areas are roundish and wrinkled, and a little depressed centrally and, though uncoloured, exist on segments forward to mesothorax.

The spiracles have a somewhat dorsal position and are brownish. There is a fringe of short hairs on anterior margin of prothorax and at extremity of last segment. The general surface looks glabrous, but there exist single hairs below the spiracles and possibly elsewhere (on primary tubercles?), and the general surface shows the skin-points as minute hairs. The prolegs have each two pads (almost united), carrying black crochets, 8 on the anterior and 7 on the posterior, in two rows, alternating but all of same size; there is also the usual separate central pad. The true legs are small (about 0·5 mm. long) and black, but brown when mounted and seen by transmitted light. They have at their bases a few short hairs, and just above each is a patch of hairs of which two are about 0·6 mm. long, four or five shorter and a few others graduating down to the ordinary skin-point hairs.

The head is black, very small for a larva of this size—0·7 mm. wide. The antero-posterior head measurement is about 0·4 mm. and of the neck 0·8 mm. It may or may not be stretched to its full length, but looks as if it were. *Arion* has a still smaller head—0·6 mm. across, but that species has a very special history as to moults, etc.

The hairs on the front margin of the prothorax are numerous and a good many are as long as those above the legs, viz. 0·6 mm. The prothoracic plate is not defined or tinted in any way; two flights of lenticles, one to either side of the middle line, may indicate its lateral wings. A few hairs about 0·25 mm. long are at the end of last segment, and the bases of the prolegs have some hairs rather longer than the ordinary skin-point hairs. On each abdominal segment from 3rd to 6th there is a longish hair (about 0·3 mm.) at the middle of the segment, a third of the distance from the proleg to the spiracle. This has about it some hairs rather larger than the usual skin-points. Dorsally, in fact above the spiracles, there appear to be no hairs, except the fine skin-points. Each of what appear to be the usual skin-points carries a very fine hair, about 0·04 to 0·06 mm. long. Small lenticles are numerous. These are only about 0·03 mm. in diameter; some have the usual dotted closing membrane, others have a central portion in the membrane somewhat denser, as though it represented an abortive hair. Most of the lenticles look as if the sides were conical frustra, nearly half their width in height. Below the spiracles they are less numerous—about 6 on the forward segments, increasing to 12 or 16 on the posterior.

Above the spiracles, the segments are divided into an anterior and posterior subsegment by a narrow band defined by the skin-point hairs being wanting for some way above the spiracles, and, across the dorsum, by a want of lenticles. On the anterior subsegment are about 80 lenticles irregularly disposed but most numerous above the spiracles, sparse dorsally. The posterior subsegment is divided into an anterior portion carrying a band of lenticles and a posterior without them; these number about 120; they are least numerous near the spiracles, but abundant on each side of the dorsal line, along which, however, they are absent. The spiracles, 0·12 mm. across, are brown (in the preparation), and are raised, by their

chitinous sides being conical, to a height nearly equal to their width.

The existence of a honey-gland is highly probable, since a local disease or injury that obscures the region and prevents a definite statement being made, is a frequent result of captivity in larvae whose honey-glands are deprived of the proper stimuli to exercising their normal activities. In this larva the gland seems to have been the centre of some disorder, causing the brown coloration of the larva, and, just outside it, is what looks like a premortem wound. The brown chitinous-looking wrinkles about it are probably merely pathological. Ordinary lenticles are not in excess about it, but there are close to it many very small, nearly colourless lenticles, about half the width of the others. There is no fan on 8th abdominal segment, but at its probable position is a chitinous arc, lost in the diseased condition on one side, but looking like a normal structure on the other.

The interior structures present various larval organs, especially tracheae and fat-masses, but no trace of anything that could be supposed to be a part of an ant larva or pupa. Indeed, the intestinal canal was barely recognisable and empty. The mandibles have eight teeth all sharp and pointed, and the middle ones rather long; they suggest, though not perhaps very decisively, a carnivorous employment. *Arion* has similar sharp teeth, but they are also found in purely vegetarian larvae, such as *icarus*. There were no traces of imaginal organs.

The pupa of *C. phasma* is of a nearly uniform dark terra cotta colour and of the usual Lycaenid form, 13·0 mm. long by 5 mm. broad. It is for the most part remarkably free from hairs and lenticles of any sort, but round each spiracle (abdominal) are a dozen or two minute hairs, colourless and glassy, about 0·06 to 0·08 mm. long: each has a solid shaft for about half its length, the remainder divided into several, usually a good many, radiating spicules sometimes arising together, sometimes a little spread over the end of the shafts; some smaller similar hairs are seen on the prothorax.

The 8th abdominal segment narrows ventrally almost to disappearance, the 9th gives a small triangular mid-ventral projection, and the 10th a rather larger rounded projection, about 1·3 mm. across and 0·7 mm. long. Dorsally the 9th and 10th are not separately distinguishable;

the rather large piece overhangs the venter and its point is the most projecting portion of the ventral line; it is about 1·6 mm. long by 2·0 broad. It terminates in a low ridge and a few points darkly chitinised, almost black, with half a dozen anchor-ended cremastral hairs.

The appendages of the male butterfly did not suggest alliance with any groups I know, certainly not with *Lycaena* (*arion* L.), and almost equally not with *strabo* (type of *Catochrysops*). I am not familiar with the group to which it belongs, but various butterflies that have the same type of markings seem to have appendages very different from each other.

X. *Description of a new Genus and Species of Tineina (Lep.) from Southern Nigeria.* By J. Hartley Durrant.

HYPONOMEUTIDAE.

Mnemoses, gen. n. (Drnt.).

(*μνῆμα* = a memorial; *σής* = a moth).

Type: *Mnemoses farquharsoni* Drnt.

Antennae 2/3, uniserrate, the serrations ciliate; basal joint elongate, somewhat enlarged, with pecten of long hair-scales. *Labial Palpi* moderate, subascending, loosely scaled, terminal joint shorter than median. *Maxillary Palpi* short. *Haustellum* moderate, scaled. *Ocelli* obsolete. *Head* loosely hair-scaled. *Thorax* smooth. *Forewings* elongate-ovate; *neuration* 12 veins; 1 furcate at base; 3 from angle, 3–5 approximate, 4 slightly nearer to 3 than to 5; 7–8 closely approximate at base, 7 to below apex; 9–10 stalked; 11 from areole, at slightly beyond half its length; a subcostal stigma above 12. *Hindwings* almost 1, subovate, evenly rounded from apex; *neuration* 8 veins; 3–4 connate, or from short stem; 4–7 nearly parallel, 5 nearer to 6 than to 4; discoidal obliquely receding from 3 to 7; 12 not connected to radius; 1^{bc} furcate at base. *Abdomen* rather long, somewhat flattened. *Legs:* hind tibiae with long hair-scales.

Apparently most closely allied to *Eremothyris* Wlsm. and *Anticrates* Meyr., but differing from both in FW. 11 arising from the areole, and in the clothed hind tibiae.

Mnemoses farquharsoni, sp. n. (Drnt.).

Antennae yellowish, basal joint white. *Palpi, Head* and *Thorax* shining white. *Forewings* chalk-white, with pale leaden grey markings: a large cordate grey patch occupies the apical third and is connected narrowly along the termen to a tornal patch expanding above the dorsum to almost half its length; above this, narrowly separated from the apical patch, is an ovate patch of the same colour, and along the costa, above and towards the base is a grey irroration, below which, on the fold, in the basal third, is a subovate grey patch; cilia shining white; underside pale leaden grey, the margins and cilia white. *Exp. al.* ♂ 18–21 mm. ♀. *Hindwings* pale leaden grey; cilia shining white. *Abdomen* shining white. *Legs* shining whitish; hind tarsi leaden grey.

Type ♂ (350184); ♀ (350185); *slide* ♀ (350187) B.M. [*PTT.* 7772–3, 7775–9, 7781, 7783, 7785–7 (Drnt. Det. 1920). Hope Dept., Mus. Oxf.].

Hab. AFRICA, W.: LAGOS: Agege, ⊕ ivory whitish, head yellowish; under mantle of gnawed bark and frass on trunks of *Hevea brasiliensis* Müll. Arg., ex. 23. IX—11. X. 1917; Jan. 17, 1918. (*C. O. Farquharson*). Fifteen specimens.

By request of Prof. Poulton this species is named after the late Mr. C. O. Farquharson.

D. DIPTERA.

XI. *A Revision of the Genus Harpagomyia de Meij.* (*Diptera, Culicidae*). By F. W. Edwards.

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Plate XVI, figs. 5–12, facing p. 517. Text Figure 6.

The genus *Harpagomyia* was founded by de Meijere in 1909 for a Culicid fly found in Java by Jacobson, with very remarkable habits, and with a most pronounced adaptation of its mouth-parts, the mandibles and maxillae in both sexes being absent. In the previous year the same fly had been described by Leicester under the name *Malaya*, but this name has been considered by the present writer (1912) to be preoccupied by the Coleopterous genus *Malaia* Heller, and that being so, de Meijere's name can be used for the genus. This is fortunate, for de Meijere's work was much more detailed than Leicester's, the latter author merely describing the external characters of a single male specimen caught in a bungalow. Shortly after de Meijere's paper appeared, the genus was again described by Theobald (1909) under the name *Grahamia*, but this was corrected to *Harpagomyia* in the last volume of his monograph (1910).

The genus may be characterised as follows :—

Eyes contiguous or narrowly separated. Head clothed only with broad flat scales with rounded ends. A pair of strong vertical bristles present, separated by a wide space from the orbital bristles. Clypeus rather long and narrow, somewhat tapering. Palpi alike in the two sexes, scarcely longer than the clypeus and in close contact with the base of the proboscis; jointing indistinct. Antennae alike in the two sexes; flagellar joints all about equal in length and with moderately long basal hair-whorls. Proboscis rather short, hairy, directed backwards beneath the body when at rest; labella very large, thicker than the proboscis and nearly one-third as long, carrying two pairs of very long curled hairs. Mandibles and maxillae absent. Prothoracic lobes separated, completely clothed with flat metallic scales, with bristles on front margin only. Mesonotal bristles developed on the sides only. Pro-epimeral and spiracular bristles both present, but few in number (1–3). No sternopleural or lower mesepimeral bristles. Postnotum bare. Male hypopygium: side pieces from 2 to 3 times as long as broad, bearing scales on the dorsal surface, no apical lobes, basal lobes scarcely differentiated, bearing a tuft of

spines, beyond which on the inner aspect of the side-piece are two additional spines; clasper simple, curved, with a short, thick, terminal spine. Tenth sternites simple, pointed, bare, with basal enlargement. Parameres small and inconspicuous. Mesosome well chitinised, divided or entire, according to the species. Female abdomen blunt-ended, eighth tergite somewhat bristly. Hind tibiae shorter than the others. Claws all simple, in the male the front pair slightly unequal. No pulvilli. Wings with the fork-cells longer than their stems, the upper somewhat narrowed towards the apex. Tip of sixth vein nearly level with the base of the fork of the fifth, and only slightly beyond the base of the second. Wing-scales pointed. Microtrichia present on membrane of wings.

Larva: Antennae short, without hair-tuft. Head tufts normal in number and position. Metathorax without strong spines. Comb of 8th segment an irregular patch of scales. Air-tube with numerous hair-tufts, on both dorsal and ventral surfaces, and with round-ended, flat, fringed scales similar to those of the 8th segment, arranged in two irregular rows on each side, apparently representing the pecten. No ventral brush on last segment.

The adults are very small dark-coloured mosquitoes with metallic markings; they live in association with ants of the genus *Cremastogaster*, which they solicit for food, obtaining it by inserting the proboscis between the ants' jaws. The larvae live in old water-filled nests of the ants (Jacobson), or in water collected at the bases of wild pineapple leaves (James, Stanton). The remarkable habits of the adults have been described in some detail by Jacobson, Banks,* James and Farquharson.

In spite of the absence of bristles on the postnotum, there can be no doubt that the genus should find a place among the Sabethini, on account of the larval characters, and the head bristles, round-ended scales and short hind tibiae of the adults.

Up to the present the following specific names have been proposed:—

Malaya genurostris Leicester (1908). Kuala Lumpur.
Harpagomyia splendens de Meijere (1909). Java.
Grahamia trichorostris Theobald (1909). Ashanti.
Harpagomyia coeruleovittata Ludlow (1911). Philippine Is.
Harpagomyia taeniarostris Theobald (1911). Uganda.

* See Theobald 1909 and Muir 1919. I have been unable to trace Banks' work.

As I have previously stated (1913), *splendens* and *coeruleovittata* appear to be synonyms of *genurostris*, almost the only difference observable between specimens from Java and Kuala Lumpur (as also from Ceylon) being in the colour of the thoracic integument, which may perhaps depend on the age of the individual. However, the Philippine species (*H. coeruleovittata*) may be distinct from *H. genurostris*, since Dr. Ludlow describes the clypeus as being "heavily covered with a rather long fine white fuzzy tomentum." This could hardly be said of any of the five species I have examined, in which the clypeus is at most pollinose, distinct "tomentum" not being visible under a magnification of 100.

The two described African species, however, are certainly distinct from one another, and from *H. genurostris*, though the distinction I have given between them (1912) does not hold good, being based on a mixed series. Besides these two, a close study of Mr. Farquharson's material, in comparison with that already existing in the British Museum, has revealed the existence of two more. It is certainly remarkable that there should be apparently only a single species in the geographically discontinuous areas of Ceylon, the Malay Peninsula, Java and the Philippines, while there are four distinct species in Africa; but this is the only conclusion possible from an examination of the available material.

The five species are all very similar; the following diagnoses include all the characters (so far as I could ascertain) which are not common to all of them.

KEY TO THE SPECIES.

Clypeus yellow.
- Eyes separated by a scaled line . . 1. *genurostris* Leic.
- Eyes practically touching . . . . 2. *taeniarostris* Theo.

Clypeus black.
- Head scales all blackish. . . . . 3. *fraseri*, sp. n.
- Head scales silvery in front.
  - Mesonotum with median silvery line. 4. *trichorostris* Theo.
  - Mesonotum without such line . . 5. *farquharsoni*, sp. n.

1. **H. genurostris** Leicester. See Plate XVI, fig. 5 × 50.

Clypeus yellow, with a silvery-grey pollinosity. Proboscis (except labella) more or less yellow. Eyes narrowly separated by a silver-scaled line. Head with a patch of bluish-silvery scales in

front. Mesonotum with a double median longitudinal row of metallic silvery scales, integument varying in colour from light brown to black. Pro-epimeral scales silvery. Abdomen with lateral patches of silvery scales on segments 2, 4, 5, 6 and 7, those on segments 2 and 4 the largest. Male hypopygium very small, often almost entirely hidden, yellowish in colour. Basal lobe of side piece with two distinct spines and several stiff hairs; side pieces less than twice as long as broad. Lobes of ninth tergite slightly prominent, with about 8 undifferentiated hairs. Mesosome divided.

The British Museum series includes Leicester's type male; 6 ♀ from Batavia, Java (*F. W. Terry*); 1 ♂ 3 ♀ bred from larvae from wild pineapple, Kuala Lumpur (*Dr. A. T. Stanton*); and 2 ♀ 2 ♂ from Colombo, Ceylon (*Col. S. P. James*).

2. **H. taeniarostris** Theobald. See Plate XVI, fig. 6 × 50.

Differs from *H. genurostris* as follows :—

Eyes practically touching, at any rate no scales on the line separating them. Pro-epimeral scales pale golden. Male hypopygium larger, blackish. Spines on basal lobe of side piece and on lobes of ninth sternite more numerous. Aedoeagus rather differently formed.

Besides Theobald's male type from Kampala Swamp, Uganda, the British Museum collection now contains a female from Dar-es-Salaam, E. Africa (*A. W. J. Pomeroy*). The mesonotum in both specimens is very much rubbed, but the female shows traces of the double median row of metallic scales, and this must therefore be presumed to be present in the male also.

3. **H. fraseri,** sp. n. See Plate XVI, fig. 8 × 50.

Clypeus blackish, with very slight grey dusting, rather shorter than in the two preceding species. Proboscis entirely dark. Eyes separated by a very narrow unscaled line. Head scales all blackish. Pro-epimeral scales silvery. Mesonotum with no trace of a double median row of metallic scales, the whole surface being covered with narrow, straight blackish scales; integument black. Abdomen with silvery lateral spots on segments 2, 4, 5, 6 and 7. Male hypopygium rather larger than in the two preceding. Side pieces over twice as long as broad; basal lobes with four or five spines besides a few hairs. Lobes of ninth tergite elongated, with five bristles, of which the apical two are stronger than the others. Mesosome not divided, not very strongly chitinised.

Described from two males in good condition in the British Museum collection from Mpumu Forest, Uganda, July 1910 (*Capt. A. D. Fraser, R.A.M.C.*). The specimens had previously been identified as *H. taeniarostris* Theobald, but are obviously distinct.

4. **H. trichorostris** Theobald. See Plate XVI, fig. 7 × 50.

Differs from *H. fraseri* as follows :—

Eyes distinctly separated by a scaled area on the upper part of the front, touching below. A large patch of metallic silvery scales on head in front. Mesonotum with double median row of metallic scales. Male hypopygium large, prominent, yellowish. Side pieces three times as long as broad, basal lobes with a tuft of about 10 spines. Lobes of ninth tergite elongate, with two strong spines at the tip and one shorter bristle internal to these. Mesosome undivided, strongly chitinised.

Known only from Theobald's type male and female from Obuasi, Ashanti (*Dr. W. M. Graham*).

5. **H. farquharsoni,** sp. n. See Plate XVI, figs. 9–11 × 50 and fig. 12 × 200.

Differs from *H. fraseri* as follows :—

Eyes distinctly separated by a scaled area on the upper part of the front, touching below. A large patch of metallic silvery scales on head in front. Male genitalia small, resembling those of *H. genurostris* except in the structure of the mesosome. Lateral silvery spots on segments 5 and 6 of female abdomen very small.

Six males and five females from Ibadan, S. Nigeria (*C. O. Farquharson*). None are in perfect condition, but none show the metallic thoracic line; two or three metallic scales are present on the front of the mesonotum in one specimen, but these may have been displaced from the prothoracic lobes.

[The material here described was sent by Mr. Farquharson in two consignments, of which the first—1 ♂, 5 ♀—was intended to illustrate the observations recorded in Proc. Ent. Soc., Lond., 1918, pp. xxix–xxxix, and was exhibited to the Society at the next meeting (pp. xxxix, xl). It was erroneously identified by Mr. Farquharson (p. xxxii) and Dr. Guy Marshall (p. xl) as *H. trichorostris* Theo., and also wrongly sexed (p. xl). The examples were

captured at a "*Cremastogaster*-tree" at Moor Plantation, near Ibadan, on Dec. 14, 1917, and the ♂ was being fed by an ant received in the same consignment—a worker of *Cremastogaster buchneri*, near *alligatrix*, if not actually this race. Of the 5 ♀, 2 are in the Coll. Brit. Mus.

The second consignment consisted of 5 ♂ (2 in Brit. Mus.) from the same locality, Aug. 10, 1918, accompanied by a sample of the ants which were feeding them. This worker ant was also near the race *alligatrix*. Similar workers were being robbed by the Cecidomyid *Farqu-*

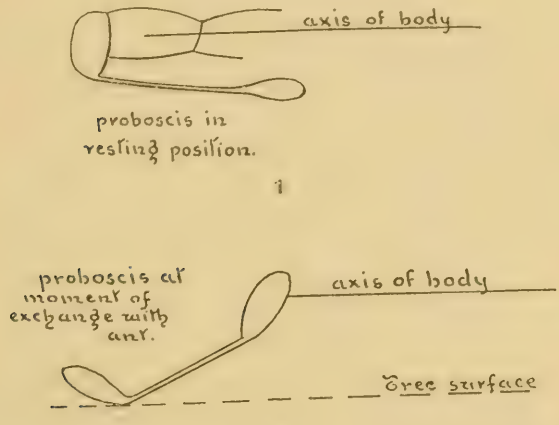

Fig. 6.

harsonia rostrata, on the same date (pp. 440–42). The ants were kindly compared by Mr. W. C. Crawley and Mr. A. H. Hamm with specimens named by Dr. Forel. The 5 ♀ in the first consignment offer sufficient evidence that this sex as well as the other is fed by the ants. Mr. Donisthorpe tells me that Dr. Jacobson does not mention the sexes of those he observed being fed by ants in Java. Dr. Eltringham has kindly traced and made available for reproduction in text fig. 6, a hurried sketch in Farquharson's letter of Dec. 23, 1917, quoted in Proc. Ent. Soc., 1918, pp. xxxiv–xxxv. The record of so accurate an observer, who had just carefully studied the insects in life, is well worth preserving.—E.B.P.]

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Explanation of Plate XVI (Figs. 5–12)

(Facing p. 517.)

Fig. 5. Male hypopygium of *Harpagomyia genurostris* Leic., seen from beneath × 50.

6. Male hypopygium of *Harpagomyia taeniarostris* Theo., seen from beneath × 50.

7. Male hypopygium of *Harpagomyia trichorostris* Theo., seen from beneath × 50.

8. Male hypopygium of *Harpagomyia fraseri*, sp. n., seen from beneath × 50.

9. Side piece of male hypopygium of *H. farquharsoni*, sp. n. × 50.

10. Anal segment and aedoeagus of *H. farquharsoni*, sp. n., from above × 50.

11. Ninth tergite of *H. farquharsoni*, sp. n. × 50.

12. *H. farquharsoni*, sp. n., internal parts further enlarged and flattened out. *a*, Tenth sternites; *b*, basal enlargement of tenth sternites, connecting them with the ninth tergite; *c*, aedoeagus (= unci of Dyar); *d*, small rods lying within the genital tube; *e*, parameres folded back ×200.

XII. *Description of a new Genus and two new Species of Cecidomyidae, and six new Species of Acalyptrate Muscidae (Ephydridae and Milichidae).* By J. E. Collin.

Plates XIV, XV, XVI (figs. 1–4), XVII.

CECIDOMYIDAE.

Subfamily :—*CECIDOMYINAE.*

Group :—*Cecidomyiariae* (*Diplosariae*).

Farquharsonia, gen. n.

Eyes connected for a long distance on upper part of head. Antennae 2 + 12 jointed, the flagellar joints in the male binodose, the two nodes being connected by a narrow neck except on the first flagellar joint, where the neck is indicated by a slight constriction; each node with an apical circlet of looped threads, the loops all about equal in length and barely reaching to the base of the following node, the apical node of each of at least the first ten flagellar joints with, in addition, a basal circlet of inconspicuous pores similar to those on the antennal joints of the female, and like them without looped threads; apical joint with a short cylindrical terminal process. Flagellar joints of female cylindrical and sessile; each with two circlets of inconspicuous pores connected by two longitudinal lines of similar pores. Palpi four-jointed, long and very slender. Proboscis extraordinarily developed, half as long again as head is deep, chiefly composed of the greatly developed paraglossae. Male hypopygium with a conspicuous triangular projection at base of the basal segment of the forceps; apical segment slender and bare with a slightly hooked tip; upper anal lamella triangularly emarginate; lower lamella longer, somewhat battledore-shaped, bearing numerous hairs round the margin, and considerably shorter than the style. Female ovipositor not extensile, terminating in two oval upper, and two very similar lower, lobes. Legs clothed with short adpressed scale-like hairs. All ungues bifid, the lower tooth shorter and more slender than the upper; empodium rudimentary. Wings rather short and broad, auxiliary vein present (more easily distinguished where viewed from beneath), cubital vein slightly down-curved and ending very little below tip of wing.

This genus is easily distinguished by the structure of the mouth-parts. If the presence of an auxiliary vein has not been overlooked in other genera of the *Cecidomyiariae*, it belongs to a group containing only a few genera, of which *Tetradiplosis* Kieff. from Argentina (known in the female sex only) also has bifid ungues, rudimentary empodium and non-extensile ovipositor.

F. rostrata, sp. n. Plates XIV, figs. 1–10; XVI, fig. 1.

♂. Eyes large occupying greater part of head. Frons and face short, brownish, the latter with a few short yellowish hairs on the lower part. Occiput rather puffed out, brownish-black with a fringe of very long curved black hairs, similar hairs being present on the lower part of head beneath the neck. A small ocellar tubercle bearing a pair of very long curved bristles. Antennae about half as long again as head and thorax together. First flagellar joint only constricted about the middle, second joint with a very short neck separating the two nodes, subsequent joints with this neck and the terminal pedicel gradually becoming slightly longer, but even on the penultimate joint they are hardly as long as the node from which they respectively arise; last node with a cylindrical pubescent terminal process devoid of bristles or pores and only a little more than one-third the length of the node; the basal node of each joint appears to bear only a single whorl of bristles, but the apical node in addition to a subapical whorl, bears numerous finer more strongly curved bristly hairs. Mouth-parts remarkably developed, the two valves of the paraglossae being produced into a huge yellow beak; each valve is thin, chitinous, semi-transparent and clothed on the convex, outer (lateral) side with yellowish hairs which become longer on the hinder edge towards the pointed tip. Inside the chamber formed by these two valves are found the much shorter labrum and hypopharynx, the latter with a long slender "tongue"-like organ reaching to the tip of the paraglossae. This "tongue" is hair-like and microscopically pubescent at the tip. Palpi yellow, four-jointed, very long and equally slender, second joint the shortest, the almost equally long first and fourth joints being slightly longer than the third. Head connected to thorax by a long slender membranous neck.

Thorax yellowish, slightly brownish on disc, with two rows of black bristly hairs (some of them very long) gradually converging to form a large V, starting behind each humerus and ending in front of scutellum; other bristly hairs are present above notopleural depression, on postalar calli, and in the form of two rather ill-defined

tufts at tip of scutellum. A fringe of similar very long bristly hairs extends from below root of wing to base of middle coxa.

Abdomen rather darker than thorax, clothed dorsally and ventrally and on basal segment of genital forceps with numerous long dark bristly hairs, especially long on hind-margins of segments. Legs yellow, but more or less obscured, especially on tibiae and tarsi, by a clothing of short adpressed scale-like hairs. Coxae, trochanters, and all the femora beneath, with rather long dark hairs. Tarsi very long and slender; ungues very small, bidentate, the lower tooth arising near the base, more slender and shorter than upper tooth; empodium absent or very short.

Wings short and broad, the costal, subcostal, and cubital veins dark, the postical and postical folds much less distinct. Auxiliary vein present but inconspicuous, most easily seen when viewed from underside of wing, this vein bears about three small pores just in front of humeral cross-vein; subcostal vein with two similar pores at its junction with costa; cubital vein with a single pore at cross-vein and two others at about three-quarters of the distance to tip. The curved scale-like hairs on both upper and lower surface of wing point towards the base of wing. Halteres with dusky knobs clothed with narrow adpressed scales.

♀. Resembling the male, but antennae shorter, with the joints all simple, longer than broad, almost sessile, and without the looped hairs of the male; the bristles on these joints do not appear to be arranged in distinct whorls, though there appear to be some stronger bristles at the base of each joint, at least on the upperside. Abdomen terminating in a non-telescopic ovipositor, bearing two pairs of ovate, short-haired papillae.

Length (not including antennae), very variable, from ·5 mm. (some males) to 2 mm. (some females).

[A description, on pp. 439–40, of the abundant material is followed by Farquharson's account of the habits. The species was captured at Agege (152 ft.), 16 m. N. of Lagos, as well as at Moor Plantation, near Ibadan, S. Nigeria. The Cecidomyids fly over the carton nests of *Cremastogaster* ants, and, approaching ants engaged in feeding others, endeavour, while hovering in the air, to abstract a portion of the regurgitated droplet. The ant was *Crem. buchneri* r. *alligatrix* at Agege, and near r. *alligatrix* at Moor Plantation.—E.B.P.]

CHAETODIPLOSIS Kieffer, Bull. Soc. Metz, xxviii, p. 103 (1913).

C. gymnastica, sp. n. Plates XV, figs. 1–8; XVI, figs. 2–4.

♂. Eyes connected for a long distance on upper part of head. Antennae 2 + 12 jointed, exceedingly elongate (quite twice as long as the insect itself) and with all the flagellar joints binodose, the nodes connected by a long narrow neck and the joints by a slightly longer pedicel arising from the distal node. Basal node of each joint globular, distal node more elongate, rather wider at tip than at base and more or less constricted about the middle (more so towards end of antennae); basal node with a circlet of looped threads of almost equal length, distal node with two such circlets; basal node with a circlet of long bristly hairs, distal node with an apical circlet of similar hairs, and in addition (especially beneath) with numerous finer more curved hairs. Apical antennal joint with a terminal appendage of which the basal half is ovate, the apical half cylindrical. Face short, yellowish, bearing a few yellowish hairs on the lower part. Palpi four-jointed, yellow; basal joint short, second and third equal, and each about twice as long as the first, fourth joint the longest, slightly longer than the third. Proboscis somewhat prominent (in a prepared specimen about half as long as head is deep), paraglossae not at all pointed. Ocellar tubercle with two long curved bristles, and other curved bristles on occiput and lower part of head beneath neck as in *Farquharsonia*, but more yellowish. Thorax and abdomen yellowish, or brownish-yellow, with bristly hairs much as in *Farquharsonia* but not so dark in colour. Hypopygium with only a very slight basal projection on inner side of basal segment of forceps, apical segment slender, bare, tip slightly hooked and apparently bifid. Upper anal lamella deeply triangularly emarginate, dividing it into two narrow pointed lobes; lower lamella closely adpressed to style, being also the same width as that organ but not quite so long and rounded at the tip. Legs long and slender, yellowish, but obscured especially on tibiae and tarsi by a clothing of adpressed, brownish, scale-like hairs. All femora with long yellowish hairs beneath. Ungues simple. Empodium very short. Wings longer than in *Farquharsonia* and all the veins yellowish; auxiliary vein present; cubital vein strongly down-curved toward the tip and ending well below apex of wing. Halteres yellow, the knob slightly obscured by a clothing of adpressed, brownish, scale-like hairs.

♀. Resembling the male, but antennae not half so long; the flagellar joints simple and cylindrical, connected by a short but

distinct pedicel; each joint with two circlets of minute pores connected by longitudinal lines of similar pores very much as in *Farquharsonia* but the pores smaller and consequently less easily distinguished. The antennae are very distinctly hairy; at the base of each of at least the first ten flagellar joints two or three straight bristly hairs on the upperside are distinctly longer and stronger than any others, the majority of the others being finer, paler, more curved, and especially numerous on the underside of each joint; appendix to apical joint with a few hairs on the ovate basal portion. Abdomen with rather shorter yellow bristly hairs and in addition with numerous very short adpressed, scale-like hairs. Ovipositor membranous, normally telescoped within the abdomen, but capable of very considerable extension, terminating above in two narrow, elongate, club-shaped papillae bearing a few short fine hairs, and beneath with two broadly sessile ovate lobes forming the lower lip of the oviduct.

Length very variable—·5 to 1·5 mm.

[Eight ♂ and 34 ♀ hanging from threads in a hollow in the trunk of *Alstonia*, containing part of the carton nest of *Cremastogaster*, Moor Plantation, S. Nigeria, Aug. 11, 1918. For Farquharson's account of the habits see pp. 442–43.—E.B.P.]

The genus *Chaetodiplosis* was described by Kieffer for the reception of *C. tropica*, a new species from Taveta in British East Africa of which he appears to have seen only a single female specimen with damaged palpi. Farquharson's species seems to agree sufficiently in venation, structure of antennae and ovipositor, as well as in having simple ungues and rudimentary empodium, to be congeneric. Certainly Kieffer described the ovipositor as having "un petit lobe ventral," whereas in *gymnastica* there are two lobes of which the greater part of each is embedded in the membrane of the lower lip of oviduct; also he laid stress upon the antennal joints having "deux verticilles de poils dont *l'inferieur a d'un côte des poils gros, raides et presque deux fois aussi longs* que ceux de l'autre côte," while not mentioning the numerous fine curved hairs which exist beneath each flagellar joint in *gymnastica*. These differences however, do not appear to justify the separation of *gymnastica* generically from *tropica*, especially so long as the male of the latter species remains undiscovered.

A single female specimen of a quite distinct species was found among the numerous specimens of *C. gymnastica*

collected by Farquharson as described on p. 442. It is easily distinguished by its straighter cubital vein ending at wing-tip, and the more ovate terminal lobes of ovipositor. In default of further material no attempt has been made to mount and describe this specimen.

EPHYDRIDAE.

RHYNCHOPSILOPA Hendel, Suppl. Ent., II, 96 (1913).

R. apicalis, sp. n.

Frons, thorax and abdomen brightly shining, glassy, with metallic blue and violet reflections. No acrostichal bristles. Tip of wing darkened.

♂ ♀. Face shining yellowish with the projecting (clypeus-like) mouth-edge whitish. Palpi dusky yellow. Arista yellow at least about the base but the hairs dark. Scutellum duller than disc of thorax; upper half of pleurae dusted greyish. Thoracic bristles long, but no acrostichals; one pair of dorso-centrals at middle of thorax very long with 2–3 smaller somewhat incurved pairs in front decreasing in length as they approach front of thorax, and one pair (shorter than middle pair) behind, half-way towards scutellum; a humeral, two notopleural, an up-curved posthumeral, two intra-alar (the hinder one very long), a small supra-alar, and two postalar bristles. Abdomen with long bristly hairs especially on the 3rd–5th segments. Front coxae, all tibiae, and tarsi except last 1–2 joints, yellow; rest of legs varying from yellowish-brown to black. Wings with the tip (including the end of the cubital and discal veins) darkened, and with a darkened patch on all the veins across the base of wing, opposite (and including) the humeral cross-vein. Halteres white with a dusky base to stem.

Length about 2 mm.

[Farquharson's material included 2 ♂ 3 ♀ examples of this species, captured between Dec. 25, 1917 and Jan. 26, 1918, at Moor Plantation, nr. Ibadan, S. Nigeria. They were feeding from the anus of dead *Cremastogaster* ants as described in Proc. Ent. Soc., 1918, pp. xxxv, xxxvi, xl. An observation made by Farquharson at a later date (see pp. 443–44) clearly shows that *R. apicalis* pursues the living ants with the same object.—E.B.P.]

The genus *Rhynchopsilopa* was distinguished from *Psilopa* Fallén by Hendel by reason of its long antennae, with the

first joint porrect, second and third drooping, third 3–4 times as long as wide, and pubescent. Only one fronto-orbital bristle and that pointing forwards. Mouth-edge projecting in front. Palpi projecting slightly beyond mouth-edge and bristly at tip. Proboscis geniculate, the middle part long, the small paraglossae bent backwards.

The type-species, *R. magnicornis* from Formosa, is stated to have a distinct bristle at end of second antennal joint directed forwards, palpi dull black, arista black, only one pair of dorso-central bristles with a row of fine hairs in front, acrostichals present ending in a pair of prescutellar bristles.

Another species, *R. rugosiscutata* Meij. from Java, appears to agree with *magnicornis* in having only one pair of dorso-central bristles, but the frontal triangle is dull black, and the scutellum and greater part of pleurae is "runzelig und dadurch ziemlich matt." It agrees more with *apicalis* in having only a very weak bristle at end of second antennal joint pointing forwards.

Neither *magnicornis* nor *rugosiscutata* have a darkened tip to wing.

MILICHIDAE.

Milichia Meigen, Syst. Beschr., vi, 131 (1830).

The following species all belong to the genus *Milichia* as at present restricted, though they differ considerably from the type species (*speciosa*). The bare mesopleurae appear to keep them out of the genus *Rhynchomilichia*, which they approach in the structure of the proboscis. The species described below as *M. farquharsoni* is the most aberrant in chaetotactic as well as other characters. It is considered advisable to retain them all in the genus *Milichia* until a better knowledge of the group has been attained.

1. M. argyratoides, sp. n. Plate XVII, fig. 1.

Dull, dark brown species. Abdomen of male almost entirely silvery. Only two parts of dorso-central and fronto-orbital bristles. Face exceedingly short. Third antennal joint darkened.

♂. Head and thorax dull dark brown. Frons wide, at vertex quite five times as wide as third antennal joint is deep, and widening out slightly towards antennae. Frontal lunule with a pair of

distinct bristles on the upper margin. Only two frontal bristles on each side of upper third of frons, the hinder one pointing backwards, the front one forwards, on rest of frons only a single row of very short incurved hairs each side and very short scattered hairs on disc. Face exceedingly short, the mouth-opening curving upwards almost to the tip of frontal lunule, leaving narrow cheeks each side which join the very narrow jowls below the eyes. A short black vibrissal bristle followed by 2–3 others, becoming shorter and finer as they approach and merge into the black hairs on lower part of back of head. Eyes microscopically pubescent. Antennae short, third joint dark brown, slightly yellowish in some lights, with a long, very distinctly pubescent, arista. Palpi very large, dilated in the shape of an equilateral triangle with rounded corners and slightly rounded sides; they are dark yellowish-brown and clothed with very short, fine, dark pubescence. Proboscis hidden between the palpi. Thorax rather greyish on humeri and right in front; front part of meso- and sterno-pleurae olive brown with a tendency to appear greyish in some lights. Disc covered with very short black hairs which leave three exceedingly narrow lines down the thorax, bare. Two pairs of dorso-central bristles, the front pair much the weaker, placed close to the hind pair and a little nearer the mid line of thorax; a strong central prescutellar pair of bristles, a humeral, a posthumeral, two notopleural, and three supra-alar bristles placed in a straight line parallel with a line joining the two strong bristles on postalar callus; four scutellar bristles with the middle pair cruciate; a tiny prothoracic bristle immediately above the base of front coxa and the usual three sternopleural bristles; mesopleura bare. Abdomen only a little broader than thorax, the long 2nd segment and the 3rd–5th segments entirely silvery-grey dorsally as in *speciosa*. Legs the colour of thorax but posterior knees very narrowly yellowish. Wings hyaline except at base as far as humeral and basal cross-veins; end of subcostal vein distinctly, and small (discal) cross-vein slightly, darkened; this latter cross-vein placed at $\frac{1}{3}$, or very slightly more, from base of discal cell; cross-vein closing discal cell sloping so that lower outer angle of cell is acute. Last portion of discal vein slightly shorter than penultimate portion and almost parallel with cubital vein. Squamae and halteres dark.

♀. Resembling the male except that the abdomen is entirely dull, dark brown and bears more numerous short black hairs. Frons slightly wider at vertex and more parallel-sided.

Length 4 mm. One pair.

[The specimens arrived in a pill-box bearing the date

(? of emergence) Sept. 10, 1915, and the locality Mamu (Gambari), in the Shagamu district about 20 miles S. of Ibadan. They were bred on the road from larvae in an exuding wound in the bark of a *Cremastogaster* ant-tree. Notes on the life-history and habits of the larvae will be found on pp. 444–45.—E.B.P.]

M. argyratoides appears closely to resemble *M. argyrata* Hendel from Formosa, which was described as belonging to the *speciosa*-group and presumably differs in having the face long, as in that species. Hendel's species also has only one pair of dorso-central bristles, while the male abdomen is twice as wide as the thorax, and the third and fourth (cubital and discal) veins slightly converge towards tip of wing.

2. **M. proectes,** sp. n.

Resembling *M. argyratoides*, but thorax rather lighter olive-brown. Abdomen with silvery patches at sides only. Antennae with yellowish third joint.

♂. Head in profile very much like that of *argyratoides* but the palpi are not so prominent and are wider at the base, while the row of bristles from vibrissal angle along the mouth-edge are longer and stronger. Face very short but distance from end point of frontal lunule to mouth-edge a little less than third antennal joint is deep. Frontal lunule with a pair of small bristles. Palpi a paler yellowish brown. In the type the paraglossae of proboscis project beyond the palpi as diverging pointed lobes bearing a few black hairs. Thoracic chaetotaxy as in *argyratoides*. Abdomen the same colour as thorax and rather narrower; viewed in some lights the sides of the first four segments are silvery, spreading very narrowly across the front margin of the third and fourth segments; front margin of fifth segment very narrowly silvery at sides. Viewed directly from behind these silvery patches appear dull black. Venter with at least the broad third and fourth tergites silvery in some lights. Legs with the front as well as the posterior knees very narrowly pale, the femora in some lights appearing silvery beneath. Wings faintly tinged with brown, the small (discal) cross-vein rather further from base of cell, last portion of discal vein rather shorter than penultimate portion and almost parallel with cubital; lower outer angle of discal cell rather acute.

Length 3·75 mm.

A single male.

[The specimen formed part of the material, captured at

Moor Plantation, near Ibadan, S. Nigeria, Dec. 23, 1917, to Jan. 26, 1918, and sent to illustrate Farquharson's observations on *Milichia* published in Proc. Ent. Soc., 1918, pp. xxxiii, xxxiv, xl, where it is shown that these flies solicit and receive regurgitated food from ants in the track running up the trunk of "*Cremastogaster*-ant-trees."—E.B.P.]

3. **M. prosaeles**, sp. n. Plate XVII, figs. 2 and 3.

Smaller and more shining than the previous two species. Abdomen distinctly shining and without silvery patches. Frons much narrower in male. Vibrissal angle more projecting.

♂. Frons only about twice as wide as third antennal joint is deep, dull brown, but varying from almost black to dull greyish brown according to the point of view. Frontal lunule with a pair of distinct bristles. Face very short, no longer than third antennal joint is deep. Both face and frontal lunule appearing silvery from some points of view. Vibrissal angle more projecting and the cheeks between face and eyes wider. A single vibrissa followed by a rather widely spaced row of short bristly hairs towards back of head. Palpi dark brown or reddish brown and pubescent, dilated leaf-like, but of a more even width throughout instead of being triangular as in the previous species. The long, very pointed, slightly hairy paraglossae of proboscis may project straight out between palpi, or be bent back and point towards prothoracic sternum. Antennae with third joint reddish brown, arista shorter than in the previous species and only microscopically pubescent. Thorax rather shining, dark brownish black; pleurae and hind part of disc in front of scutellum dusted greyish. Chaetotaxy as in *argyratoides* except that middle bristle of the three supra-alar bristles is not in a line with other two but placed rather higher up on disc. Abdomen very distinctly shining and blacker than thorax, the black hairs short and not very numerous. Tergites extremely narrow on first three segments, widening out into a triangle on fourth, and still wider on fifth, segment. Legs with the knee joints very narrowly, and the joints of coxae and trochanters indistinctly yellowish, hind femora at base with a long, fine, postero-ventral, bristly hair. Wings short and rather broad, faintly tinged with brown and distinctly brownish along the costa from humeral cross-vein to end of subcostal vein. Cross-vein closing discal cell not so sloping as in *proecles*; last portion of discal vein about two-thirds length of

penultimate portion and slightly diverging from cubital vein. Squamae and halteres dark, the latter with a yellowish base to stem.

♀. Resembling the male but frons nearly twice as wide and very faintly shining. Abdominal tergites of more equal width throughout.

Length barely 3 mm.

One male and five females.

[Two specimens, a ♂ and ♀, formed part of the material captured at Moor Plantation, near Ibadan, S. Nigeria, Dec. 23, 1917, to Jan. 26, 1918, and sent to illustrate Farquharson's notes in Proc. Ent. Soc., 1918, pp. xxxiii, xxxiv, xl. The remaining 4 ♀♀ were captured in the same locality, in May, 1918, on the evidence of a letter of May 28 (see p. 445). They formed part of a set of "absolutely guaranteed mendicants" (pp. 415-16), soliciting food from *Cremastogaster* ants.—E.B.P.]

4. **M. dectes**, sp. n.

Closely resembling *M. prosaetes* but wings without the brown streak along costa at base of wing, and thorax and abdomen more densely pubescent.

♂. Frons nearly double as wide as in *prosaetes* ♂ and with the bristles (especially ocellar and vertical) longer. Thorax blacker, without the slight brownish tinge of *prosaetes* and with more numerous short hairs; notopleural depression and disc of scutellum with a greyish tinge in some lights; supra-alar bristles almost in a straight line. Abdomen with a distinct greyish tinge about the base of the second segment except at the sides; the short black hairs with which the abdomen is clothed very much more numerous. Tergites of moderate width throughout. Wings without any indication of the brownish costal streak of *prosaetes*.

♀. Resembling the male, frons only slightly wider than in *prosaetes* ♀. The greyish tinge about the base of second abdominal segment not so conspicuous as in the male. Slightly smaller than *prosaetes*.

Two males and four females.

[A single ♀ formed part of the material of Dec. 23, 1917 to Jan. 26, 1918, and the remaining 2 ♂, 3 ♀ a part of the series of "absolutely guaranteed mendicants," as described under *M. prosaetes*.—E.B.P.]

5. **M. farquharsoni**, sp. n. Plate XVII, figs. 4–6.

Superficially somewhat resembling the two previous species, but with the second antennal joint longer, a

proboscis of remarkable structure, and different thoracic chaetotaxy and costal lobe.

♀. Head rather wider than thorax. Eyes microscopically pubescent. Frons almost a third the width of head, parallel-sided, brownish, and dull on the broad central stripe and at vertex, more greyish and slightly shining on the narrow orbits next to eye-margin. Chaetotaxy as in other species. Frontal lunule small, shining, the usual pair of bristles very short and fine. Face only slightly narrower than frons, longer than in any of the other species, flat and dull greyish. Cheeks rather distinct, of almost equal width throughout and merging into the jowls which become very narrow at lower margin of eyes. No distinct vibrissae—only a row of short fine hairs. Antennae placed very close together at base, first joint very short, indistinguishable on the outer side but visible as a ridge on the inner and lower sides; second joint long, dull brownish black, almost as long as the third joint which is rounded in outline and strongly compressed laterally; inner side of second and third joints clothed with a curious soft fine curved pubescence; third joint yellowish brown at least about the base. Arista microscopically pubescent, second joint long. Palpi greyish brown, of almost equal width throughout and laterally compressed, closely approximating at the upper mouth-margin and then widely diverging, this diverging portion being somewhat concave on the inner side; the margin of this concave part and the whole of the lower side of the palpi clothed with similar soft fine curved pubescence as on inner side of antennae. Proboscis geniculate, the basal part much flattened, bare on the central part but clothed with short dark hairs at the sides, terminal part (paraglossae) of a curious shape, compressed laterally and bearing on the upperside towards tip some remarkable long bristly hairs.

Thorax rather dull brown with an aeneous tinge; pleurae dusted greyish. Chaetotaxy as in the other species except for the absence of the posthumeral, supra-alar (as distinct from postalar) and central prescutellar, bristles. Abdomen brilliantly shining black except on the first segment and a large dull greyish patch occupying the greater part of disc of second, and (to a rather less extent) of third segment; the moderately short black hairs, scattered, not very numerous, and more upright on fifth segment.

Legs black with the tip of anterior tibiae and all tarsi (except for the last joint or two) yellowish, but the front tibiae are brownish yellow on basal part, and the hind tarsi are rather brownish on the basal joint. Hind tibiae with a rather sinuous antero-dorsal ridge, behind which is a flattened and slightly concave space, brilliantly

shining, with violet reflections, down which runs a single row of short black bristles. Wings with a faint yellowish tinge and yellow veins. End of subcostal vein sharply marked black, emphasised by the fact that the costa just before the break at this point is produced into a black lobe. Small (discal) cross-vein opposite end of subcostal vein, ends of cubital and discal veins distinctly converging, and last portion of latter vein distinctly longer than penultimate portion. Squamae dusky with pale brown fringes. Halteres black with brownish-yellow stems.

Length barely 3 mm.

Five females.

[All the specimens formed part of a set of "absolutely guaranteed haunting flies," captured in May, 1918, on the evidence of a letter of May 28 (see p. 445), at Moor Plantation, S. Nigeria. These flies were haunting the carton nest of *Cremastogaster* ants as described on pp. 445–46. They were not seen to receive food from the ants like the other species here described.—E.B.P.]

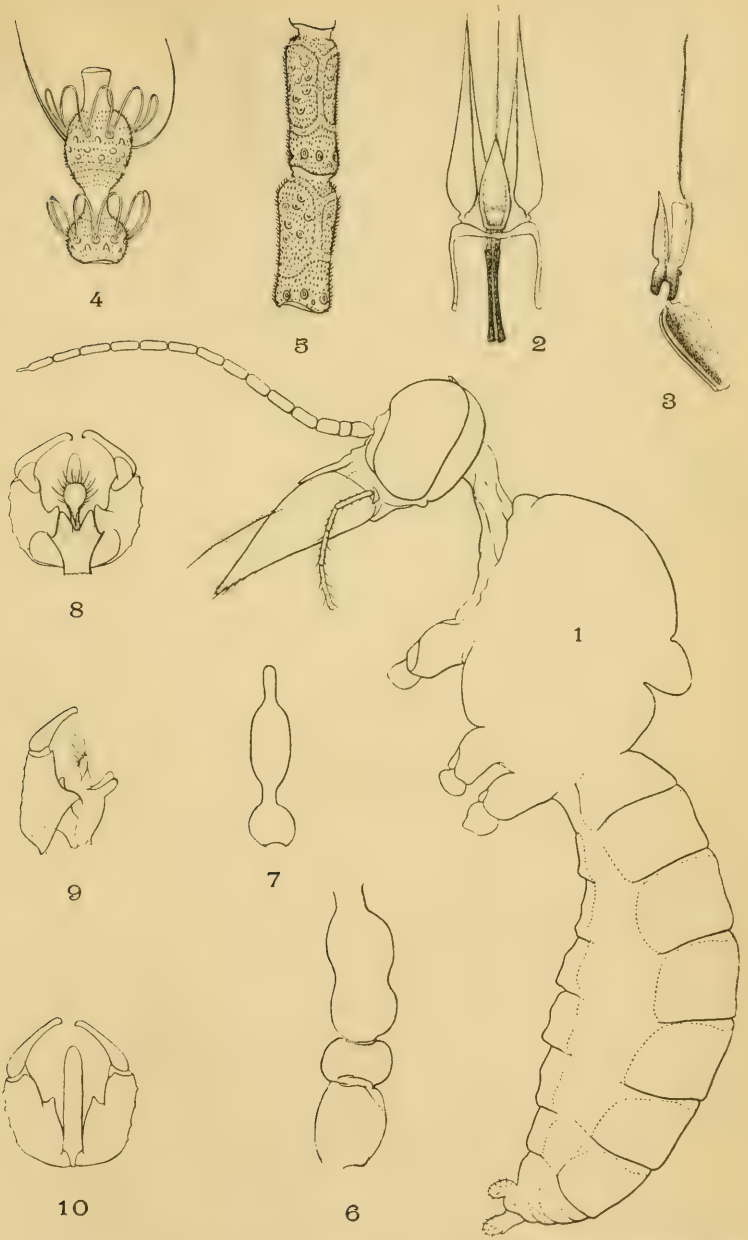
Explanation of Plate XIV.

PLATE XIV.

Farquharsonia rostrata, sp. n.

Fig. 1. Outline of female × 33.
2. Mouth-parts of female from in front × 40.
3. Side view of labrum, hypopharynx, etc. × 40.
4. One of the middle joints of male antennal flagellum, much enlarged. (Only one of the straight and one of the curved bristles figured.)
5. One of the middle joints of female antennal flagellum, much enlarged. (No bristles figured.)
6. Outline of first three joints of male antenna, much enlarged.
7. Outline of terminal antennal joint of male, much enlarged.
8. Hypopygium of male from above × 60
9. Hypopygium of male from right side × 60.
10. Hypopygium of male from beneath × 60.

Bristles on basal joint of forceps not figured.



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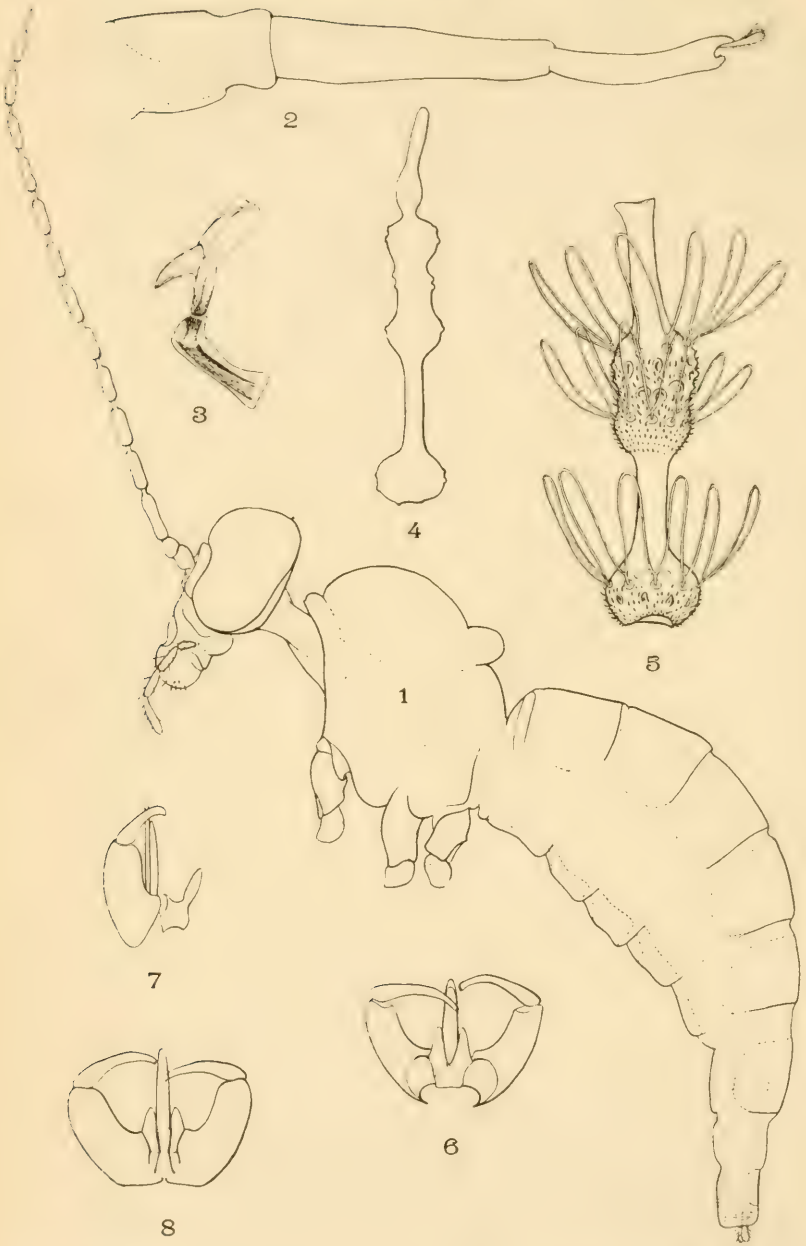
FARQUHARSONIA ROSTRATA, A S. NIGERIAN CECIDOMYID.



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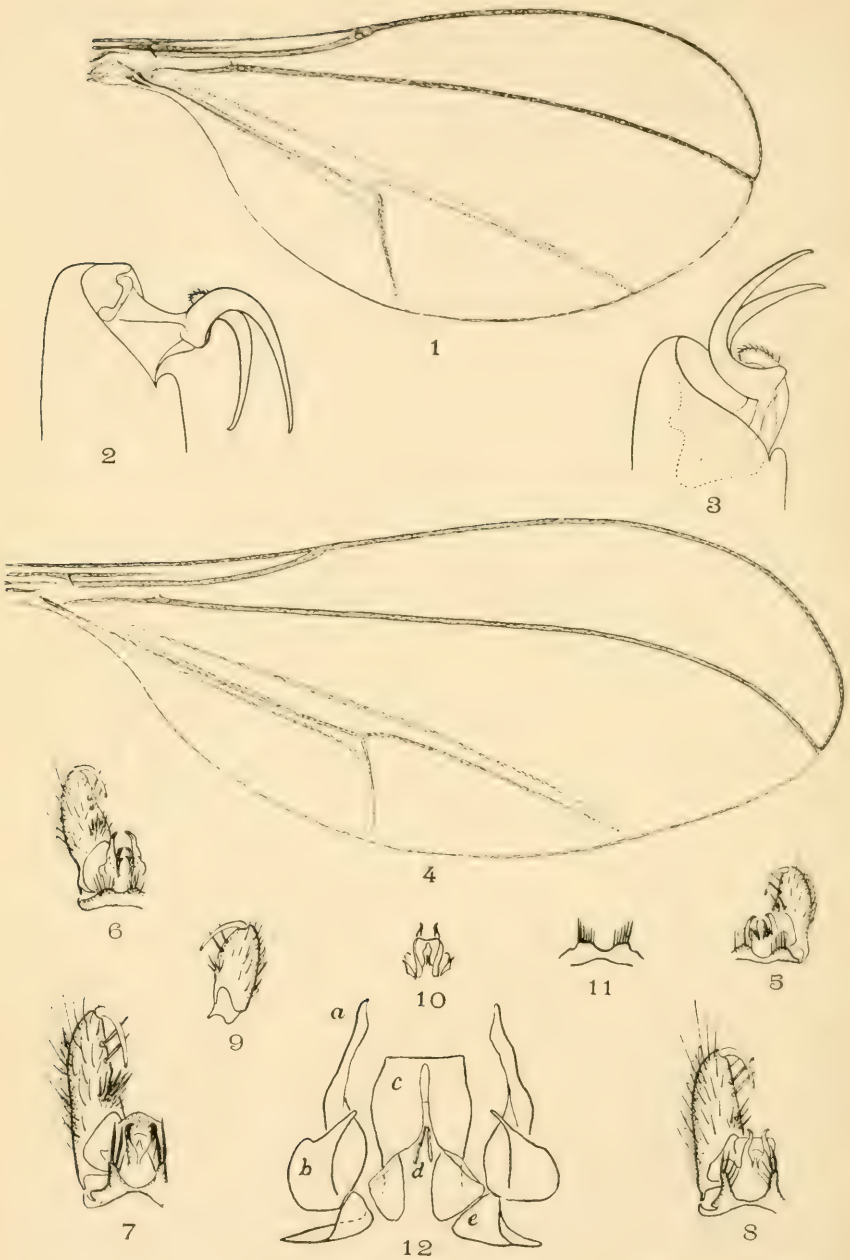
CHAETODIPLOSIS GYMNASTICA, A S. NIGERIAN CECIDOMYID.



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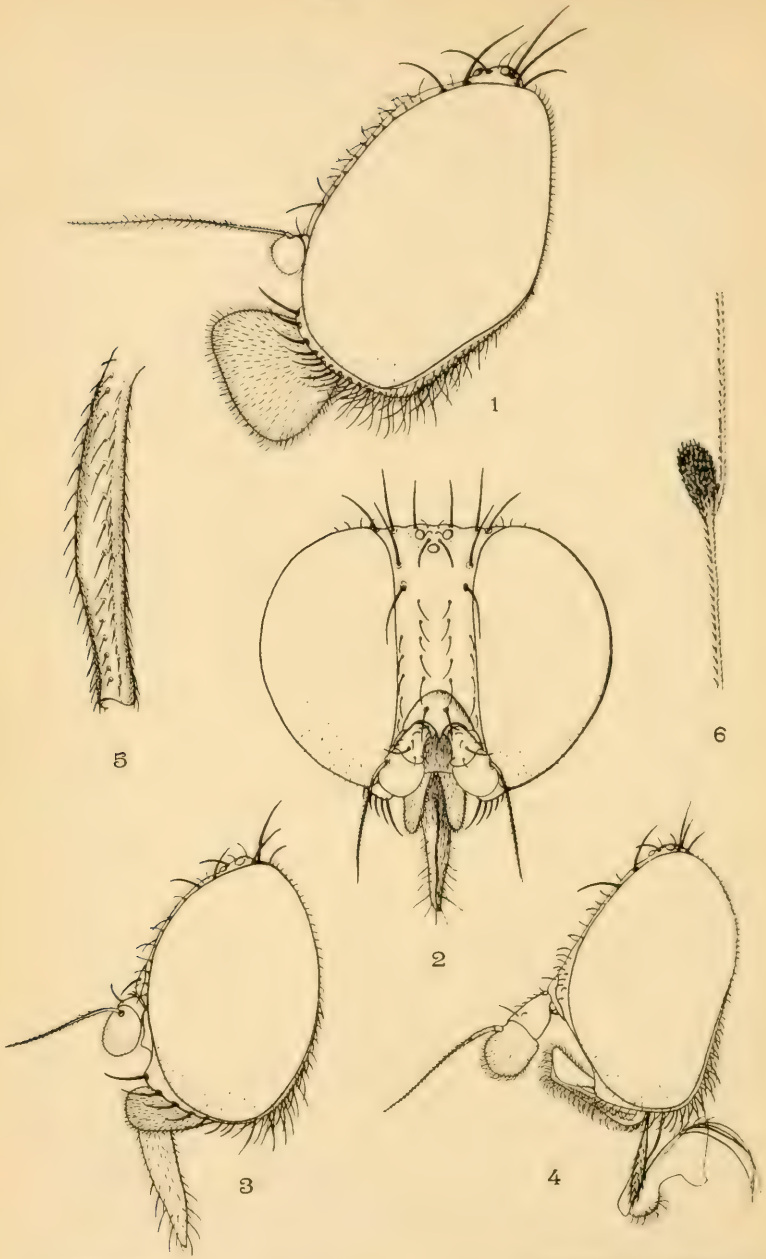
FARQUHARSONIA (1), CHAETODIPLOSIS (2 4), AND HARPAGOMYIA (5–12).



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S. NIGERIAN SPECIES OF MILICHIA (Diptera).

Explanation of Plates XV, XVI (Figs. 1–4), XVII.

PLATE XV.

Chaetodiplosis gymnastica, sp. n.

Fig. 1. Outline of female × 33.
2. Female ovipositor extended × 40.
3. Side vein of labrum, hypopharynx, etc. × 60.
4. Outline of terminal antennal joint of ♂, much enlarged.
5. One of the middle joints of male antennal flagellum, much enlarged. (No bristles figured.)
6. Hypopygium of male from above × 60.
7. Hypopygium of male from right side × 60.
8. Hypopygium of male from beneath × 60.

Bristles on basal joint of forceps not figured.

PLATE XVI (Figs. 1–4).

Fig. 1. *Farquharsonia rostrata.* Wing venation × 33.
2. *Chaetodiplosis gymnastica.* Ungues extended, much enlarged.
3. „ „ Ungues at rest, the base withdrawn into the end of the tarsal joint as indicated by the dotted lines, much enlarged.
4. „ „ Wing venation × 33.

(For explanation of figs. 5–12, illustrating Mr. F. W. Edwards' paper, see p. 503.)

PLATE XVII.

Fig. 1. *Milichia argyratoides* ♂. Profile of head × 23.
2. „ *prosaetes* ♂. Front view of head × 23.
3. „ „ ♀. Profile of head × 23.
4. „ *farquharsoni* ♀. Profile of head × 23.
5. „ „ ♀. Left hind tibia from above × 33.
6. „ „ ♀. Costa at end of mediastinal vein viewed from front edge of left wing × 33.

XIII. *Descriptions de six Tachinides nouveaux d'Afrique.* Par le Dr. J. Villeneuve.

1. **Exorista poultoni**, n. sp.

♂. D'un noir brillant, oblong. Epaules et tête à enduit gris jaunissant et mat; péristome ardoisé; thorax à légère pruinosité grise en avant, sur laquelle apparaît l'origine de trois fines lignes noires médianes, distantes; scutellum largement rougeâtre au bord libre; abdomen rougeâtre sur les flancs des segments II et III. Antennes allongées, un peu plus courtes que le clypéus, noires ainsi que les palpes qui sont assez épais au bout. Pattes noires, à griffes antérieures longues. Ailes hyalines, jaunies à la base; cuillerons amples, jaune d'œuf; balanciers à massue obscure.

Vertex large comme 2/5 d'œil. Une seule soie verticale; soies ocellaires aussi développées que les 2 paires de soies frontales ascendantes; 4 soies descendant sur les gênes jusqu'au niveau du chète antennaire, celui-ci ayant le 1er article distinct, le 2e nettement allongé, le 3e épaissi dans sa première moitié. Occiput sombre, avec quelques rares cils en arrière des cils rétrooculaires. Péristome à peine large comme le vertex. Yeux à longue pilosité blanchâtre.

Thorax: 4 soies dorsocentrales; 2 + 2 soies sternopleurales.

Scutellum: 4 soies longues, de chaque côté; les apicales croisées.

Abdomen: 1er segment excavé à fond; segments I et II ayant 2 soies marginales médianes, courtes et plutôt faibles, III et IV avec une rangée complète de soies longues et robustes. Pas de soies discales sur les 3 premiers tergites.

Pattes: tibias postérieurs à cils fins et à peu près réguliers, mêlés d'une longue soie médiane.

Ailes: 3e nervure portant 2 cils à son origine; coude de la nervure IV presque à angle droit; transverse apicale modérément arquée; transverse postérieure oblique, à peine sinueuse. Pas d'épine costale.

Taille: 8 millim.

[The unique type bears the label "ex Pterocarpus Lycaenid." It was bred at Moor Plantation, near Ibadan, in March, 1917, probably from *Deudorix diyllus*, p. 382.—E.B.P.]

2. **Hilarella helva**, n. sp.

Port et taille de *H. stictica* Meig., mais d'un jaune chamois clair sur l'abdomen qui ne présente ni taches noires latéro-dorsales ni taches latérales, seulement une bande grisâtre médio-dorsale sur

laquelle tranchent les pores largement auréolés de noir profond des 2 macrochètes médians; thorax et scutellum d'un gris jaunissant uniforme, de même sur les gênes, tandis que le front est un peu doré. Palpes jaunes. Cuillerons ocracés. Pattes brunes, à tibias testacés.

[The unique type was bred on June 20, 1915, from a Noctuid larva, the prey of *Ammophila beniniensis*, as described on pp. 426–27. Locality : Moor Plantation, near Ibadan.—E.B.P.]

3. **Tricyclea evanida**, n. sp.

♀. De taille moyenne, entièrement d'un jaune pâle à l'exception : (1) d'une large bande cendrée sur le thorax où elle occupe l'espace compris entre les soies dorsocentrales, en le débordant un peu; (2) du mésophragme entièrement noir; (3) d'une bande noire postérieure sur les segments abdominaux II et III, bande assez large qui donne un prolongement médian triangulaire n'atteignant pas le segment précédent et qui s'amincit vers les flancs pour devenir étroite sous le ventre. Le dernier segment est marqué à ses 2 angles postérieurs d'une tache noire transversale.

L'occiput, noirâtre et plus ou moins poudré de gris, est assez largement bordé de jaune derrière les cils retrooculaires. Ces cils s'arrêtent, en bas, au niveau du bord inférieur des yeux et, de là, s'étendent sur la partie supérieure du péristome. Ailleurs, le péristome est couvert de poils blancs, sauf à l'angle postérieur où quelques longs poils noirs font suite aux soies du bord inférieur.

Les palpes sont dilatés au bout en raquette.

Ailes hyalines, sans épine costale et sans aucune tache noire; cuillerons et balanciers presque blanchâtres.

4 soies dorsocentrales. 3e tergite abdominal avec une rangée complète de soies marginales parfois couchées; 4e tergite avec quelques soies disco-latérales qui sont dressées ainsi que la rangée des soies apicales : toutes ces soies sont développées.

Taille : 7–8 millim.

Plusieurs femelles de la Nigeria, de l'Ouganda et de la Côte-d'Or.

[A single *evanida* was found by Dr. Villeneuve among 5 ♀ Tricycleas bred by Farquharson in October or early November, 1917, from larvae referred to in the following note :—

" *Dec.* 12, 1917.—Another tube contains some other Dipterous larvae of which imagines are sent. These feed on the débris that is piled up round the nest openings of

the ant *Paltothyreus*. The little mounds were simply heaving with these maggots. I was only able to breed out a few before I went travelling." [See p. 436.]

Of the remaining 4 ♀ bred from Farquharson's larvae Dr. Villeneuve wrote Apr. 9, 1920 :—

" Les 4 premiers exemplaires sont *T. exarsa*, bien pareils au type de Brauer-Bergenstamm, qui est encore chez moi, et au type de Guérin-Méneville de la collection Macquart, étiqueté aussi '*exarsa* W.' et qui est aussi chez moi."

Concerning the ♂ of *T. evanida* and *exarsa*, Dr. Villeneuve wrote, also on Apr. 9, 1920 :—

" Le ♂ ayant une bande brune le long de la moitié distale de la nervure II de l'aile, n'appartient pas certainement à *T. evanida*, mais est très probablement un ♂ de *T. exarsa* B.-B. IMMATURE. J'ai trouvé le vrai ♂ de *T. evanida* ; son aile est pareille à celle de la ♀, c'est à dire sans aucune tache ni bande."

Inasmuch as nothing is known (Proc. Ent. Soc., 1914, p. v) of the life-history of *Tricyclea*, v.d. Wulp (=*Zonochroa* B.-B.) it is very satisfactory to know that the larvae of *T. evanida* and *exarsa* have been found in the débris of *Paltothyreus tarsatus*, and that the three following new species have been seen to oviposit in and round the nest openings of Driver ants (*Dorylus*).—E.B.P.]

4. **Tricyclea semithoracica**, n. sp.

♂♀. De taille moyenne ou plus petite, d'un jaunâtre terne, à l'exception : (1) d'un espace noirâtre occupant la partie comprise entre les soies intraalaires, depuis la suture jusqu'au scutellum; ce rectangle noir est parfois étroitement échancré au milieu de son bord antérieur; (2) du mésophragme noirâtre; (3) des dessins noirs des tergites abdominaux, à savoir : une bande étroite de chaque côté du tergite I, sur son tiers externe—une bande plus large, complète, élargie en triangle à sa partie médiane jusqu'à rejoindre le tergite précédent, distingue le tergite II—les tergites III et IV sont presque entièrement noirs, le premier n'ayant plus de jaune que les angles antérieurs et le second qu'une tache médiane apicale.

L'occiput est noirâtre entièrement; les cils noirs rétrooculaires descendent jusqu'aux soies du péristome qui est lui-même couvert de poils noirs épars.

Palpes en massue.

Ailes à deux taches noires le long du bord antérieur, l'une occupant la cellule médiastinale et la débordant jusqu'à joindre la nervure II, l'autre tache allongée et entourant l'extrémité de cette nervure.

L'espace clair qui les sépare est à peu près de la longueur de la tache médiastinale. Au-delà de la nervure II, le rebord costal de l'aile est étroitement ombré, davantage à l'extrémité de la 1ere cellule postérieure. Cuillerons à peine ocracés; balanciers jaunâtres.

4 soies dorsocentrales—les 2 derniers tergites abdominaux bordés de soies raides, espacées et peu longues; les soies disco-latérales du tergite IV débiles.

Le ♂ a les yeux joints, à facettes ordinaires.

Taille: 6–7 millim.

Je connais cette espèce de la Nigeria et de la Côte-d'Or. [W. A. Lamborn's material, submitted to Dr. Villeneuve, included 4 ♀ of this species, observed on Dec. 10, 1913, to be dropping their ova into and between the openings of a temporary nest being constructed by Driver ants (*Dorylus*) at Moor Plantation, near Ibadan, S. Nigeria, as described in Proc. Ent. Soc., 1914, pp. v–vii. Farquharson had directed Lamborn's attention to the ants and thus prompted the observation.—E.B.P.]

5. **Tricyclea verticella**, n. sp.

♂♀. Jaune, ayant le thorax entièrement noir en dessus, à l'exception des épaules et d'une étroite bande latérale qui restent jaunes jusque près de l'insertion des ailes; pleures maculés de noirâtre. Scutellum largement noir à sa base. Abdomen légèrement brillant; les tergites ont chacun une bande marginale noire: étroite et largement interrompue sur le segment I, large et complète sur les segments II et III où elle s'amincit un peu latéralement, réduite à 2 taches apicales sur le segment IV.

Le mésophragme et l'occiput sont entièrement noirs; la même coloration s'étend sur le vertex et couvre fréquemment la moitié postérieure du front.

La disposition des cils rétrooculaires et la vestiture du péristome sont comme dans l'espèce précédente; les palpes sont également en massue.

Les ailes, un peu sales, ont une tache noire occupant toute la cellule médiastinale et reposant sur la nervure II, puis, séparée de la première par un court espace clair, une autre tache brune, très allongée, enveloppant l'extrémité de la nervure II et continuée par une zone ombrée plus claire le long de la côte jusqu'à la terminaison de la 1ere cellule postérieure. Cuillerons sales; balanciers testacés.

Les pattes ont l'extrémité distale des fémurs postérieurs et les tibias correspondants plus rembrunis que dans la plupart des espèces du genre *Tricyclea*.

Normalement, 3 soies dorsocentrales développées; entre la 1ère et la 2e, une soie plus courte et plus faible est interposée. Les soies marginales du tergite abdominal III sont courtes et couchées, mais robustes et longues latéralement; celles du dernier tergite sont développées, tandis que ses soies disco-latérales sont courtes ou débiles.

Le ♂ a les yeux joints, à facettes ordinaires.

Taille: 5–7 millim.

Nombreux individus de la Nigeria, un de l'Ouganda et un du Congo belge.

[A single ♀ of *T. verticella* was found by Dr. Villeneuve in Lamborn's material illustrating the observations summarised under *T. semithoracica*.—E.B.P.]

6. **Tricyclea perpendicularis**, n.sp.

♀. Cette espèce est comme intermédiaire entre les deux précédentes. De *T. verticella*, elle a le scutellum à large tache basale noire, l'abdomen de même coloration et à soies identiques. Comme chez *T. semithoracica*, les ailes hyalines ont 2 taches noires et disposées de la même manière; les pleures sont pâles avec la seule tache noire habituelle, l'hypopleurale; le thorax montre tout le tergum d'un gris bleuté en arrière de la suture, avec cette différence qu'il s'en détache une bande médiane de même couleur qui s'avance dans l'espace compris entre les soies acrosticales présuturales; la tête, enfin, est la même.

Palpes en massue—4 soies dorsocentrales.

Taille: 5–6 millim.

2 ♀ de la Nigeria méridionale.

[A single ♀ of this species also was found by Dr. Villeneuve in the material which contained *verticella* and *semithoracica*. All three species therefore are known to be attracted to Driver ants and to drop their eggs into and between the funnel-shaped openings of a temporary nest. The ants did not appear to notice the eggs, "but in the natural course of their work gradually covered them with earth." (Proc. Ent. Soc., 1914, p. vi.) This material had been submitted to Major Austen, who separated the three species exactly as Dr. Villeneuve has done.

Two other Diptera also ovipositing, although in a different manner, among the Driver ants on the same occasion (*ibid.*, p. vii) were also submitted to Dr. Villeneuve who has kindly written the following note, also confirming, and

in *Rhinia* carrying somewhat further, Major Austen's conclusions.

" Quant à *Rhinia apicalis* Wied., vera, c'est la variété avec une tache obscure à l'extrémité de l'aile. Ici, c'est la variété '*testacea R.D.*, 1830' : l'aile et l'abdomen n'ont aucune tache noire sur votre specimen.

" L'Anthomyide paraît être du genre *Limnophora :* il est en trop mauvais état pour être déterminé."—E.B.P.]

XIV. *Description of a peculiar unidentified Dipterous Larva possessing a number of enigmatic truncate Abdominal Organs.* By J. Bronté Gatenby, D.Phil.,D.Sc., Professor of Zoology, Trinity College, Dublin, Senior Demy, Magdalen College, Oxon.

Plate XVIII.

Among the material sent to Prof. E. B. Poulton by Mr. C. O. Farquharson was a small unidentified larva believed to be a Syrphid. Cursory examination of this larva showed that it possessed, on the ventral surface of the last third part of its body, a number of peculiar tubes arranged in two bunches set side by side. The ultimate region of the abdomen was found to bear a tracheal funnel, in somewhat the same manner as the larva of *Eristalis tenax*. In the unidentified larva, however, the funnel did not seem to be extrusible and extensile as in the rat-tailed Syrphid larvae. In Plate XVIII, fig. I, the larva is drawn to the centimetre scale given above. In front were two processes, short and with few joints, which were the antennae; the mouth-parts did not appear to be abnormal. From 1*a* to 6*a* in this figure were six pairs of processes surmounted by numbers of hooklets as in the *Eristalis* larva. Behind the last pair of leg-processes were found the truncate organs already mentioned (Plate XVIII, fig. I, Tu). In fig. II the organs on one side are drawn at a higher power. Each one was seen to have at its extremity a minute pore. Just behind the region of the truncate organs the body tapered sharply, but before passing on to the tracheal funnel it gave rise to two lateral, backwardly directed obtuse processes (PR in fig. I).

The entire surface of the larva was covered with raised processes or rugosities, and the epidermis was markedly thick and pigmented towards the hind regions, somewhat like the *Eristalis* larva. Nothing of special interest was found in connection with the nervous or alimentary system, but the latter was of the complicated type found in many Dipterous larvae. The anus opened in the region of the truncate organs between the two bunches, so that the trunk-like tubes are really peri-anal. The two lateral tracheal tubes open behind at TT in fig. I. There are no

lateral stigmata, but there is apparently a pair in the head region as in the *Eristalis* larva.

The hind regions of this larva were sectioned in order to examine the truncate tubes. In Plate XVIII, fig. IV, there is drawn a transverse section of the body in the region of the tubes; one of the latter is cut in longitudinal section, while two others, at DP, are just in the section. In fig. IV it will be noticed that the tube is hollow, from the pore upwards, to the place marked by the legend Tip. At this region the main tube is seen to be folded again to form an inner tube; to the inner tube are fixed some muscle bands at M; these are attached to the body-wall of the larva in the region of the tubes. Inspection of fig. IV at once shows that each tube is really arranged so as to be eversible by pressure of the fluid of the body, and the muscle at M functions in redrawing the tube when once everted. In fig. V the tube is diagrammatically represented as half everted, the tip (Tip in fig. IV) being now outside; in fig. VI the eversion is complete. The attachment of muscle is at MA.

It was found that the hypoderm cells of the truncate tubes were very large and glandular.

Probable Function of Eversible Truncate Organs.—In fig. III is a diagrammatic drawing of a larva with its tracheal funnel above water taking in air; the eversible organs are shown protruded to their fullest extremity. There seems little doubt that these organs, connected as they are with the haemocoel, and everted by haemocoelic fluid pressure, serve as additional respiratory organs, when the larva is in water too deep to enable it to use its tracheal funnel. A less likely suggestion might be that the organs are used for climbing and adhering to water-weeds.

Systematic Position of Larva.—Until the fly is bred from this larva, it will be impossible correctly to place it in its position, but in arrangement of legs, in the appearance of the integument, in the shape of the body, and in the tracheal apparatus, this larva shows undoubted affinities with the form *Eristalis*.

[The following extracts from Farquharson's letters confirm Prof. Gatenby's suggestion that the protrusible processes are respiratory in function.—E.B.P.]

Dec. 12, 1917.—You will remember my telling you of the (?) Syrphid larva with the curious protrusible process, that I found in the decaying banana leaves in water. I

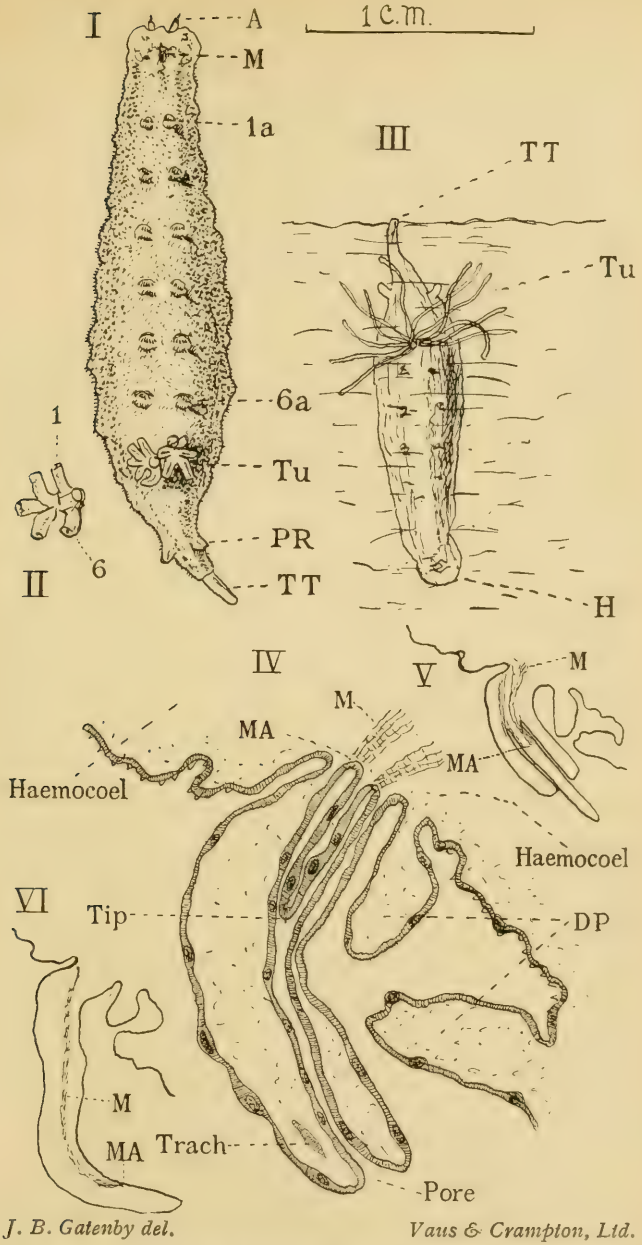
have failed to breed out the imago so far, but hope to have another try. The specimen sent shows the organ—a fusion, I think, of a pair—extruded, but much contracted in the spirit. In life it was quite transparent with branched silvery lines running out to the tips of the fingers or lobes. These I believe to be tracheae. I will send more larvae when I can get them.

Aug. 11, 1918.—I am sorry that I overlooked those Syrphid larvae. I will place "baits" of pieces of cut banana stem in putrid water for them, and, if I get any started, I shall try to leave them with Dr. Connal to complete the life-history if they do not pupate before I go. I thought that the white "line," running out into each lobe of the curious organ, was a trachea or branch of one, as I think I mentioned at the time. The organ shrinks in spirit, but in life it was a very pretty structure, the lobes being quite translucent with the silvery white line running out to the end of each. The whole organ can be withdrawn out of sight inside the body of the larva. I think I will manage to fix that little problem up all right.

Note (*October 1921*).—Prof. E. B. Poulton, whom I have to thank both for the opportunity of examining this material, and for encouraging interest during the work, has drawn my attention to Mr. Farquharson's reference to "silvery lines" running down the tubes. These lines I think must be the muscles marked M in fig. VI, and not tracheae, as one might naturally expect.—J. B. G.

Plate XVIII.

[*For Explanation of Figs.* I–VI *see accompanying text.*]



J. B. Gatenby del. *Vaus & Crampton, Ltd.*

A S. NIGERIAN AQUATIC DIPTEROUS LARVA
(? Syrphidae).

E. THYSANOPTERA.

XV. *Notes on Selenothrips rubrocinctus Giard, taken by C. O. Farquharson on a Forest Tree at Agege, near Lagos.* By R. S. Bagnall, F.R.S.E., F.L.S.

Selenothrips rubrocinctus Giard.

Physopus rubrocincta Giard, 1901.
Heliothrips rubrocinctus Franklin, 1908.

This species is a great pest of Cacao in the West Indies and is also known from Ceylon. It was described fully by Franklin in 1908. Its specific name is due to the broad band of bright red (almost crimson) hypodermal pigmentation running across the base of the abdomen in the larva. At a later date Karny wrote upon his conception of the divisions of the genus *Heliothrips* (Revision der Gattung *Heliothrips* Haliday in Entom. Rundschau, Jahrb. 28, No. 23, pp. 179–182) and diagnosed the subgenus *Selenothrips* for the reception of *rubrocinctus*, and a new and closely allied form, *S. decolor* Karny, found on Cacao in New Guinea.

The presence of *S. rubrocinctus* on the W. Coast of Africa is particularly interesting in view of the fact that I have only recently received a supply of the other species, *S. decolor*, from the Gold Coast, where it is injurious to Cacao. *S. decolor* is most readily separated from *rubrocinctus* by the absence of the red hypodermal pigmentation at the base of the larval abdomen. There are also minute structural differences in the antennae.

[The specimens on which Mr. Bagnall's note was written were preserved in spirit. The following note accompanied them: "Rather large Thrips from bush tree at Agege. Immature forms run about with drop of dark liquid at posterior end.—Oct., 1917."—E.B.P.]

F. HOMOPTERA.

XVI. *A new Southern Nigerian Aleurodes* (*Aleurodidae*). By Prof. R. Newstead, F.R.S.

Plate XIX, facing p. 531, Fig. 1.

Aleurodes africanus, sp. n.

Pupa Case (fig. 1*a*). Flat, broadly ovate, segmentation distinct; dorsum very finely rugose, the rugosities very narrowly separated by extremely fine striae arranged somewhat radially; anal furrow distinct. Fringe or other secretionary matter absent. Colour dark brown or black with a broad, clearly defined, translucent margin; stigmatic clefts and anal furrow dusky white and clearly defined; vasiform orifice pale yellow. Margin (fig. 1*b*) very faintly crenulated and with fine but well-marked sutures or striae. Dorsal pores (fig. 1*c*) small, forming an irregular series just within the striated border. Eye-spots (fig. 1*d*) small. Vasiform orifice (fig. 1*e*) somewhat subcordate; the operculum filling a little more than half the orifice; lingula, when fully extended, projecting almost to the distal margin of the orifice, densely setose and furnished with a pair of short spinose hairs arising from a subapical collar of chitin. Stigmatic clefts (fig. 1*f*) well defined, terminating with three short, dactyliform processes. Anal cleft (fig. 1*g*) with two pairs of processes; the distal pair similar to the corresponding ones in the stigmatic clefts; the proximal pair somewhat triangular.

Length, 1·2–1·3 mm.; width, 1·1–1·2 mm.

Larva, second instar. Narrowly ovate; margin similar to that of the pupa case. Vasiform orifice with the operculum transversely elliptic and not quite extending to the middle distance, central area of the distal edge very finely spinose; lingula as in the pupa. Anal furrow distinct, distal angles each with a slender spinose hair; there is also a similar spinose hair at the margin considerably in advance of them.

Length, 0·6–0·7 mm.

W. Africa: S. Nigeria, Moor Plantation, nr. Ibadan, May, 1917. C. O. Farquharson.

[The *Aleurodes*, attached to the under surface of the leaves of *Salacia* sp. (*Celastraceae*), in Farquharson's compound, formed the food of the carnivorous Noctuid (*Erastriinae*) larva of *Eublemma scitula* (pp. 407–408.—E.B.P.]

The pupa-case of this insect does not agree in all its details with any of the new genera erected by Quintance

and Barker.* I have therefore placed it in the genus *Aleurodes*, from which it differs, however, in having the "submarginal area" faintly separated from the "dorsal disk" and also in its form and colour.

* Classification of the Aleurodidae, U.S. Dept. Agr. Tec. Ser. No. 27, Pt. ii (1914.)

XVII. *A new Southern Nigerian Lecanium* (*Coccidae*).

By Prof. R. Newstead, F.R.S.

Plate XIX, Fig. 2.

Lecanium (Saissetia) farquharsoni, sp. n.

Female adult. Form hemispherical, or narrowly ovate and highly convex; margin very thick, forming a distinct rounded moulding or bead. Integument with a faintly matted surface when preserved in alcohol, due apparently to secretion or foreign matter, on the removal of which, by slight friction, the derm presents a polished appearance. Colour rich dark castaneous; immature examples dusky buff. Antennae of eight segments; the 3rd equal to or a little longer than the 2nd. Legs robust; anterior pair with an unusually long bristle on the trochanter; tarsus inclusive of the claw about equal in length to the tibia. Anal lobes (fig. 2*a*) forming together a distinctly pyriform outline, the distal margin being about half the length of the lateral and markedly rounded; distance from distal margin of the lobe to the anal margin of body one-fourth the entire length of the body. Anal cleft fused. Stigmatic clefts obsolete; spines three or four in number. Marginal spines (fig. 2*b*) of varying lengths and irregularly disposed, some of them more than twice the length of the longest stigmatic spines; some of them are quite simple; others are slightly frayed distally. Derm cells irregularly ovate closely packed together. Collectively they produce a reticulated pattern at the margins.

Length, 4–4·25 mm.; width, 3·50 mm.

Young adult ♀. Form more or less circular or broadly ovate with the front slightly narrowed or produced; dorsum low convex or more or less flat. Colour dusky buff or pale ochreous. Antennae (fig. 2*c*) of eight segments, the 3rd slightly the longest. Stigmatic clefts faintly indicated, spines (fig. 2*e*) similar to those in the old adult. Derm cells at the margin as in the mature examples, but much less pronounced in the central area. Anal cleft not completely fused, and placed in the same position relatively to the margin of the body, as in the old adult.

In the nymphs or second stage ♀ the anal cleft is not fused.

W. Africa: S. Nigeria, Moor Plantation, Dec. 1917. C. O. Farquharson.

[The Coccidae were found on a plant of *Imbricaria maxima* (*Sapotaceae*) and formed the food of a carnivor-

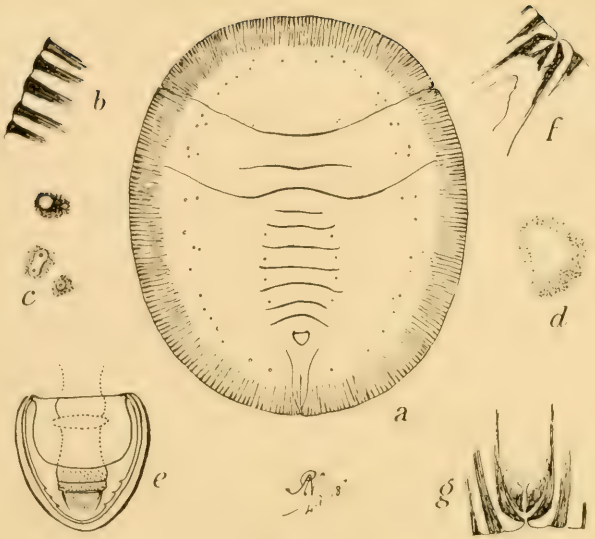


FIG. 1.

Fig. 1.—ALEURODES AFRICANA Newst.

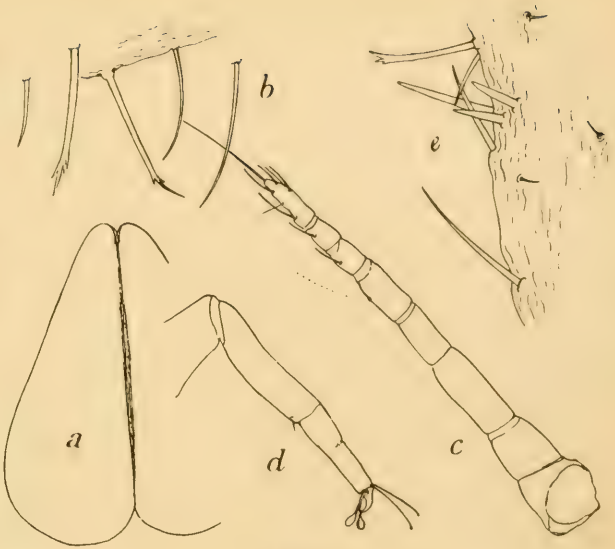


FIG. 2.

Fig. 2.—LECANIUM (SAISSETIA) FARQUHARSONI Newst.

Vaus & Crampton, Ltd.

ous Lycaenid larva, *Triclema lamias* (p. 387). See also Proc. Ent. Soc., 1918, p. xxx.—E.B.P.]

In its general external facies this insect is inseparable from *Lecanium* (*Saissetia*) *somereni* Newst.,* but the anal lobes and marginal spines in *L. farquharsoni* are markedly different. In its structural details it is much more closely related to *L. catori* Green,† but the anal lobes are placed much nearer the margin of the body than in the last-named species; some of the marginal spines are distinctly though finely divided, laterally, towards the tips, and the longest stigmatic spines are shorter than the longest marginal ones.

* Mitteil. Zool. Mus. Berlin, V, pt. 2, p. 162, fig. 5 (1911). Bull. Ent. Res., Vol. IV, p. 76.

† Bull. Ent. Res., Vol. VI, p. 43, fig. 1 (1915).

Explanation of Plate XIX.

Fig. 1. *Aleurodes africanus* Newst.: *a*, pupa case; *b*, margin; *c*, dorsal pores; *d*, eye-spot; *e*, vasiform orifice; *f*, stigmatic cleft; *g*, anal cleft.

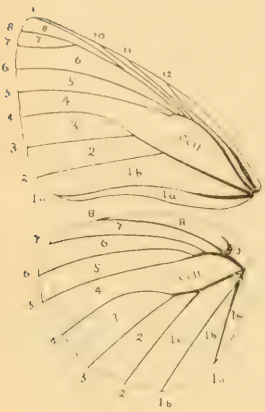
2. *Lecanium* (*Saissetia*) *farquharsoni* Newst.: ♀ adult: *a*, anal lobes; *b*, marginal spines. ♀ young adult: *c*, antennae; *d*, anterior legs; *e*, stigmatic spines: (*a*, *c* and *d* to the same magnification).

XIII. *On the African Species of the Genus* Neptis *Fab.* By H. Eltringham, M.A., D.Sc., F.Z.S.

Plates XX—XXV.

[Read Oct. 5th, 1921.]

The Genus *Neptis* was founded by Fabricius in 1807. It includes many species of small or medium-sized butterflies usually characterised by white or yellow markings on a sepia black ground-colour. Two species occur in Europe. The genus extends over the whole of the African and Oriental regions and into Australia. The wing neuration is as shown in the accompanying diagram. Its arrangement is fairly constant, though there is a certain instability in the point of origin of the tenth nervule in the fore-wing, which may arise at or beyond the end of the discoidal cell. The fore-feet are of the usual Nymphalid character, and serve as an easy method of distinguishing the sexes. The hind-feet have two simple claws, a well-developed pulvillus, and very rudimentary paronychia.



The characteristic patterns and markings of *Neptis* are such that the species are unlikely to be confused with those of any other genus except *Athyma*. If the example be a male, it may be distinguished as *Neptis* from the fact that the hind-wing costal nervure (8) ends on the costa in *Neptis*, whilst in both male and female *Athyma* this nervure ends on the hind margin. If it be a female, *Neptis* may be distinguished by the precostal nervure, which is straight where it arises from the costal, whilst in *Athyma* it follows a continuous curve from its origin; also in *Neptis* the subcostal nervures in the hind-wing arise much nearer to the costal than in *Athyma*. Further, in *Athyma* there is near the origin of the fore-wing median nervure a short spur on the inner marginal side. Such a spur is absent in *Neptis*.

The larvae are but little known. That of *dumetorum* will be described under that species.

The present paper is an attempt to deal with the forms and species of the Ethiopian region, though it cannot claim to be a complete revision, owing to lack of sufficiently long series of many forms. It may be that collectors generally, deceived by the great monotony of pattern and colouring, have neglected the genus in the belief that comparatively small series of specimens were sufficiently representative. It may be that some of the forms are really comparatively rare. In either case the fact remains that many species are but poorly represented in collections, whilst the difficulty of identification has led to numerous errors of nomenclature. So far no serious effort seems to have been made to investigate the relationships of the various described species, though at the same time, considering the fine distinctions and in some cases almost indescribable differences between what are really separate species, the literature of the genus is not wanting in certain shrewd diagnoses of their affinities.

As a problem in taxonomy the genus presents a number of difficulties, some of which in the absence of adequate material still remain unsolved. There are genera of Lepidoptera in which the male armature furnishes good and constant characters, enabling us to confirm or amend conclusions founded on outward and more easily observed features. In other cases we know that these anatomical structures are of so simple a nature that they are of little value in specific diagnosis.

In the African forms of *Neptis* we have in some instances instability of pattern combined with variability of anatomical structure, each condition tending to throw doubt on conclusions based on the other. Some species can be isolated with ease on well-differentiated characters of the male armature. In other cases we have forms very different in outward appearance, but not constantly distinguishable in the anatomical characters. If, for example, we take two forms A and B, of different pattern, and dissect and examine the genitalia, one mounted specimen of each may show recognisable differences. If, however, we take another example of A the armature may present differences from the first specimen of A, such differences being as great as those between B and the original A. Again, we may make preparations from two examples C and D, whose external

differences are of the slightest and by no means so great as the outward variations of undoubted forms of the same species, only to find that the respective armatures are so completely distinct that specific identity is out of the question.

Furthermore, there are forms, the external facies of which are so utterly different that we are bound to regard them as well-separated species, but the male armatures are not merely doubtfully distinguishable but of a highly complex form.

The form of the male armature also raises another question. Given several distinct types of structure in these organs, each type being broadly distinguishable from the others, how far are we justified in assuming that the members of the genus referable to one particular type of armature are necessarily more nearly related to each other than to species whose armatures fall under another type – that, in fact, they form an intra-generic group? If we do this with *Neptis* it is true that the majority of forms in groups so constituted seem fairly naturally associated, but at the same time there are instances in which two or more forms of totally different outward facies have armatures which are not constantly distinguishable. Thus *trigonophora* and *kikideli* are apparently widely separated, and yet it would be impossible to decide from a number of preparations which belonged to the former and which to the latter. This is not a question of a very simple structure of the armatures, since the claspers of these two species are of a curious form considerably elaborated and totally unlike those of any other African species.

A far more complicated case is that of the forms which include *ochracea*, *exaleuca*, *woodwardi*, *swynnertoni*, *incongrua*, and other species. At first sight the only difference between *exaleuca* and *ochracea* is that of colour. Grünberg on one occasion referred to an example of *ochracea* as *exaleuca* var. *ochracea*, a terminology I should have been inclined to support in the absence of anatomical preparations. Nevertheless, we find that whilst the claspers in *ochracea* are of fairly constant form, and that a peculiarly specialised one, those of *exaleuca* are extremely variable, though none of the variations resembles the clasper of *ochracea*. Close as is the resemblance between these two species in everything except colour, the clasper of *ochracea*, whilst apparently constantly distinguishable from that of

exaleuca, is not easily distinguishable from that of *incongrua*, *woodwardi*, *neavei*, and, most remarkable of all, *nemetes*. All these species are totally different in outward appearance from *ochracea* and from each other.

Again, the form described by Lord Rothschild as *neavei* is outwardly almost indistinguishable from the previously described *swynnertoni*, yet the armature of *swynnertoni* approaches that of *exaleuca*, to which species it has no outward resemblance whatever, whilst the claspers of *neavei* resemble those of *ochracea*, with which again there is no outward agreement. Where the structure of the armature is of a particularly simple kind and not subject to any characteristic elaborations no difficulty arises. Where, however, that structure is found to be highly modified, and also of a very distinct character as compared with other forms in the same genus, we should at first sight be tempted to suppose that those species possessing a distinctive type of armature were therefore closely related. But, as we now see, in the genus *Neptis* there are species whose armatures are most closely similar and highly specialised, which, to judge by their outward facies, are very widely separated. At the same time there are forms which appear nearly allied in their outward characters, but have markedly different genitalia.

Apart from the foregoing examples we have the difficulty of the forms of *nysiades* described more fully under the heading of that species.

Dr. W. J. Holland (Bull. Am. Mus. Nat. Hist., xliii, 6, p. 164, 1920) proposes a new genus, *Neptidomima*, in which he places one species *Neptis exaleuca*. He bases this separation on the structure of the palpi, which he describes as " more robust, porrect, and hirsute " than in any species known to him. It is true that the palpi in this species are densely clothed with flat scales, most of them black. The same, however, applies to the palpi in *woodwardi*, *ochracea*, *incongrua*, and some other species. If we are to take this character as generic, then the other species named must also be included in the new genus. Now, the genital armatures of these forms are of the same character as that of *nemetes*, certainly a true *Neptis*. For reasons stated above I cannot, in this genus at least, attach too much importance to the armature as a test of near affinity; nevertheless, the establishment of a separate genus for *exaleuca* and the other species with similar palpi

seems to me unnatural and based on very insufficient characters. As Heron pointed out years ago (see Trans. Ent. Soc., 1911, p. 7), the palpi of *Acraea johnstoni butleri* differ from those of other species of *Acraea*, including all the other forms of *johnstoni* itself. As *butleri* is merely a local form of *johnstoni*, we have here an example in which the difference in the palpi is not even a specific character. It is perhaps not irrelevant to add that the name *Neptidomima* is in any case undesirable, since it suggests a genus whose members mimic *Neptis*. Thus the generic names *Crenidomimas*, *Mimacraea*, *Pseudacraea*, etc., all have a significance which is well understood and supported by considerable evidence, whereas *Neptis exaleuca* and its allies, so far from being mimetic of other species of *Neptis*, are of all the genus the most aberrant in their facies.

In the descriptions it will be noted that several species have a pearly iridescent area on the underside of the h.-w. in the male. Special scales can be observed in this area, and my friend Dr. F. A. Dixey has kindly examined them for me. It would not, however, appear that they are of specific importance.

I have pleasure in acknowledging the kind assistance I have received from Dr. F. A. Dixey, F.R.S., Mr. J. J. Joicey, Dr. K. Jordan, M. Ch. Oberthür, Prof. E. B. Poulton, F.R.S., Mr. N. D. Riley, Lord Rothschild, F.R.S., and Mr. G. Talbot. I should like also to express my appreciation of Mr. Alfred Robinson's admirable photographs, from which the plates of imagines have been printed.

KEY TO THE AFRICAN FORMS OF THE GENUS *NEPTIS*.

(The sexes are alike in pattern.)

Some or all of the discal spots and bands of upperside yellow.	*a*.	
All paler markings above, white (rarely bluish).	*g*.	
(*a*) F.-w. cell on underside contains white dots, usually also visible above.	*b*.	
Cell without white dots.	*d*.	
(*b*) F.-w. inner marginal spot absent or only faintly developed . . .	*comorarum*.	(545)

F.-w. with a well-marked inner-marginal spot, sometimes confluent with spots in 2 and 3.	*c.*	
(*c*) Expanse about 50 mm., h.-w. discal band only about 3 mm. wide, distally edentate	*dumetorum.*	(543)
Expanse about 35 mm., h.-w. discal band about 5 mm. wide, distally regular .	*mayottensis.*	(545)
(*d*) Discal yellow band broad (4–5 mm.) quite or nearly continuous from inner margin of h.-w. to f.-w. area 3, its proximal margin almost a straight line.	*e.*	
Yellow band narrower (2–3 mm.) and having a curved proximal outline from inner margin of h.-w. to f.-w. area 3.	*f.*	
(*e*) F.-w. band continuous from inner margin to area 3	*ochracea.*	(554)
F.-w. band interrupted by ground-colour in anterior half of 1*b* . .	*ochracea ochreata.*	(554)
(*f*) H.-w. band nearer to base than to hind-margin, short and pale ochreous .	*woodwardi.*	(553)
H.-w. band nearer to hind-margin than to base, long and deep yellow . .	*frobenia.*	(542)
(*g*) Base of h.-w. beneath practically unicolorous with rest of ground-colour (generally red-brown) not striped or spotted.	*h.*	
Base of h.-w. beneath striped or spotted.	*m.*	
(*h*) White spots within f.-w. cell.	*i.*	
No white spots in cell.	*j.*	
(*i*) On h.-w. underside a small white spot in area 6	*neavei.*	(556)
No white spot in area 6 . . .	*swynnertoni.**	(556)
(*j*) Underside ground-colour red-brown or orange-brown.	*k.*	
Underside ground-colour ochreous .	*exalcuca exalcuca.*	(555)
(*k*) H.-w. underside without heavily marked dark internervular rays . . .	*incongrua incongrua.*	(552)
H.-w. underside with heavily marked dark internervular rays.	*l.*	

* This is the principal difference between typical *neavei* and *swynnertoni*, and it is not a constant one. Nevertheless, the male armatures differ. (See under descriptions.)

(*l*) F.-w. with three or four minute white dots beyond cell, h.-w. white band about 2 mm. wide	*incongrua occidentalis.*	(553)
F.-w. without such minute dots, h.-w. band about 5 mm. wide . . .	*exaleuca suffusa.*	(556)
(*m*) Base of h.-w. beneath irregularly marked and spotted not with regular pale bands on a dark ground.	*n.*	
Base of h.-w. beneath with curved bands of white or whitish on a dark ground	*r.*	
(*n*) F.-w. cell nearly all white.	*o.*	
F.-w. cell dark or only with white dots .	*p.*	
(*o*) H.-w. discal band only about 3 mm. wide	*metella.*	(548)
H.-w. discal band about 5 mm. wide .	*metella* f. *gratilla.*	(549)
(*p*) F.-w. subapical spots in 5 and 6 not separated by ground-colour . .	*nemetes* f. *carpenteri.*	(551)
F.-w. ditto separated by ground-colour, at least proximally.	*q.*	
(*q*) H.-w. discal band about 5 mm. wide and not markedly projecting outwards in area 5	*saclava.*	(546)
H.-w. ditto about 3 mm. wide and with prominent discal projection in area 5	*saclava* f. *marpessa.*	(547)
(*r*) F.-w. cell dark above like ground-colour, or with only minute white dots, not with sharply defined streaks or spots (*trigonophora* sometimes has a diffused white streak in f.-w. cell above).	*s.*	
F.-w. cell contains more or less white, at least some part of which is sharply defined.	*h'.*	
(*s*) F.-w. discal band practically continuous from nervure 2 to, or nearly to, costa (nervule 4 may be rather blacker than the rest, but see footnote on *seeldrayersi*, p. 539).	*t.*	
F.-w. discal band discontinuous, generally owing to reduction of spot in area 4.	*a'.*	
(*t*) F.-w. cell on upperside has white dots.	*u.*	
Ditto rarely with faint paler markings, but not in the form of dots.	*w.*	

(*u*) F.-w. delicate submarginal lines are continuous, interrupted only by the nervules.	*v.*	
These lines less distinct between nervules 3 and 4	*agatha.*	(558)
	*jordani.**	(560)
(*v*) H.-w. discal band extends beyond nervule 6	*sceldrayersi.*†	
H.-w. ditto does not extend beyond nervule 6	*livingstonei.*	(561)
(*w*) Proximal edge of f.-w. discal band straight.	*x.*	
Ditto concave or indented.	*z.*	
(*x*) F.-w. discal band sharply defined, the nervures only very faintly marked.	*y.*	
Discal band formed of elongated white spots rounded and deeply indented distally between nervules . .	*nysiades* (part).	(584)
(*y*) F.-w. discal band almost pyriform and pointed at costal end. Submarginal lines on both wings markedly white .	*nina.*	(580)
Ditto narrower towards costa, but not pyriform. Submarginal lines not so markedly white	*puella.*	(579)
(*z*) F.-w. band somewhat indented distally by ground-colour, especially in 3 and 4, band composed of spots of nearly equal length . . .	*nysiades* f. *continuata.*	(584)
Ditto with the spot in 2 very small and only touching that in 3 at its inner anterior angle	*nysiades* f. *metanira.*	(584)
Ditto with spots in 4, 5, and 6 considerably longer than those in 2 and 3 .	*nysiades* f. *conspicua.*	(584)
	nicomedes f. *puelloides.*‡	(579)

* No absolutely constant character can be given to distinguish these two species; *jordani* is smaller than the average size of *agatha*, and the ground-colour is paler. In *jordani* the discal band is more consistently narrowed towards the costa.

† Occasional examples of *sceldrayersi* have the f.-w. band separated into elongated spots by an increased blackening of the nervules. Such examples are distinguished from *nysiades* by the white dots in f.-w. cell above.

‡ *Puelloides* can generally be distinguished from *conspicua* by its smaller size and the interruption of the f.-w. submarginal lines in area 3 and often in 6.

(*a'*) F.-w. band does not reach costa, only just extending as a narrow longitudinal streak beyond nervule 6 .	*nysiades* f. *clarei*.	(584)
F.-w. band reaches costa or at least into area 8.	*b'*.	
(*b'*) F.-w. cell distinctly dotted with white.	*c'*.	
F.-w. cell dark, though rarely with vestiges of an ill-defined streak.	*c'*.	
(*c'*) White band of both wings very broad (6–10 mm.) and continuous from h.-w. inner margin to nervule 4 of f.-w. .	*kikideli*.	(569)
White band not so broad and distinctly interrupted in area 1*b*.	*d'*.	
(*d'*) The fine line just beyond the discal band is almost straight between the nervules	*rogersi*.	(568)
This line is well arched (proximally concave) between the nervules, especially in 2, 3, and 4	*barnsi*.*	(567)
(*e'*) On h.-w. underside distal to white band a row of large more or less rounded dark spots on a lighter ground-colour.	*f'*.	
Without such spots.	*g'*.	
(*f'*) H.-w. beneath with conspicuous costal white band extending from base to about middle of costa . . .	*poultoni*.	(551)
H.-w. beneath with such band if visible at all very short and not extending along costa	*nemetes nemetes*.	(549)
(*g'*) In f.-w. cell beneath is an elongated curved clavate spot followed by two to four very small spots beyond cell .	*trigonophora*.	(570)
F.-w. beneath with an irregular narrow white mark along costal edge of cell and a transverse streak across end of cell	*nysiades* (part).	(584)
(*h'*) On h.-w. upperside the innermost of the three white submarginal lines is widened so as to form a conspicuous white band at least 2 mm. wide.	*i'*.	

* Strand's *nysiades urungensis* appears to come here, but there is no figure of it and the description is not sufficiently detailed to decide on its exact position. It may even turn out to be one of the above two species.

This line at most only slightly wider than the others, not more than 1 mm. — *k'*.

(*i'*) A narrow but continuous longitudinal white stripe in f.-w. cell, but no transverse stripe . . . . — *rothschildi*. (574)

A transverse white stripe across end of f.-w. cell. — *j'*.

(*j'*) F.-w. cell with a longitudinal white stripe . . . . . — *paula*. (574)

Ditto with three transverse marks progressively smaller proximally . . — *biafra*. (571)

(*k'*) Discal band of f.-w. continuous from area 2 to, or nearly to costa, or only just interrupted by nervule 4. — *l'*.

F.-w. band markedly interrupted at nervule 4. — *m'*.

(*l'*) In f.-w., proximal edge of spots in 2 and 3 forms a straight line at or nearly at right angles to the long axis of spot in 4 . . . . — *nicomedes quintilla*. (579)

This proximal edge is S-shaped without a sharp angle . . . . — *nicomedes nicomedes*. (578)

(*m'*) White marks in f.-w. cell are transverse and usually three in number. (When very faintly developed=*nysiades* typical) . . . . . — *nysiades* (part). (584)

White stripe in cell longitudinal. — *n'*.

(*n'*) In f.-w. cell a white wedge-shaped mark followed distally by a contiguous triangular patch of greyish white scales . . . . . — *jamesoni*. (563)

Without such greyish patch (rarely with a few grey scales). — *o'*.

(*o'*) Discal spot in area 4 of f.-w. is a mere narrow line touching nervule 5, such line nearly as long as the spot in 5 . . . . . — *nicoteles*. (576)

F.-w. discal spot in area 4 not of this form. — *p'*

(*p'*) F.-w. spot in 4 well-developed and at least as long as that in 5 . . — *strigata*. (582)

This spot, if present at all, very small and isolated. — *q'*.

(*q'*) The white streak in f.-w. cell is long and narrow and just above the origin of nervule 3 is sharply indented anteriorly but not quite divided by the ground-colour. Beneath, this indentation usually contains a white dot	*nebrodes.*	(562)
F.-w. cell streak otherwise formed.	*r'.*	
(*r'*) F.-w. discal spots in 2 and 3 and in 5, 6, and 7 are not notably separated and so form two conspicuous white patches, very little white in cell .	*melicerta* f. *goochi.*	(581)
F.-w. discal spots divided by more or less complete invasions of the ground-colour.	*s'.*	
(*s'*) F.-w. discal spots 5 and 6 very short, almost rounded. Inner marginal spot obsolescent	*nicobule.*	(577)
F.-w. discal spots 5 and 6 elongated, inner marginal spot or spots well developed.	*t'.*	
(*t'*) White mark in f.-w. cell beneath followed distally by a curved white line parallel with its distal outline .	*lermanni.*	(564)
Without such line.	*u'.*	
(*u'*) A well-developed triangular spot just distal to f.-w. cell stripe . . .	*melicerta.*	(580)
Without such triangular spot . .	*mixophyes.*	(576)
	*nicodice.**	(577)

1. Neptis frobenia. Pl. XX, fig. 1; Pl. XXIV, fig. 1.

Fabr., Ent. Syst. Suppl., p. 425 (1798); God., Enc. Meth., 9, p. 130 (1823); Boisd., Faune Mad., p. 51 (1833); Trim., Trans. Ent. Soc. Lond., p. 335 (1866); Mab., Hist. Mad. Lep., 1, p. 170, pl. 20, f. 5, 6 (1885–7); Auriv., Rhop. Aeth., p. 166 (1898); in Seitz, Macrolep., p. 199, pl. 48*c* (1913).

* I can find nothing in the description of *nicodice* to distinguish it from *mixophyes* except its size. The former is said to have an expanse of 48 mm. and the latter 32 mm. Size is of little value in the genus. I have before me examples of *agatha* varying 20 mm. in expanse.

Mauritius.

Expanse about 38 mm. Ground-colour uniform umber brown. On f.-w. a narrow hind-marginal border very slightly paler followed inwardly by a second and sometimes a third slightly paler line. On inner margin near angle a small, not always well-defined spot of deep yellow, traversed by nervule 1. In areas 2 and 3 deep yellow spots forming a large ovate discal mark, its long axis nearly at right angles to costa. Three subapical spots of deep yellow forming a rather irregular mark in 5, 6, and 8, the middle spot the largest and that in 8 the smallest. On h.-w. a discal band of deep yellow almost pointed at anal angle, but widened gradually to nervule 4, thence somewhat narrower, and barely reaching the costa, its proximal edge nearly straight, its distal tending to concavities between the nervules. Marginal and submarginal narrow borders somewhat paler than ground-colour.

Underside. Paler and duller ground-colour. In f.-w. a trace of a white line across end of cell. In h.-w. the discal band white or faintly pinkish, sharply defined proximally, but distally shaded into ground-colour and followed by two pale zigzag lines whose angles lie on and between the nervules. In the male there is a silky opalescent area on inner margin of f.-w. extending to nervule 2.

Neptis frobenia is not very common in collections. It is easily identified and has a very different appearance from that of any other species. The male clasper is very like that of *comorarum*. Owing to lack of material I am unable to say whether the small differences shown in the drawing are constantly recognisable. Aurivillius gives Madagascar as a locality for this species, but there appears to be no record of its occurrence on that island.

2. Neptis dumetorum. Pl. XX, fig. 2; Pl. XXIV, fig. 2.

Boisd., Faune Mad., p. 50, pl. 7, f. 6 (1833); Mab., Hist. Mad. Lep., 1, p. 169, pl. 20, f. 3, 4 (1885–7); Oberth., Etud. d'Ent., 13, p. 14 (1890); Metamorph., Oberth., *l. c.* 12, p. 14, pl. 4, f. 2*c*, 2*d* (1888); Auriv., Rhop. Aeth., p. 166 (1898); Poulton, Proc. Ent. Soc. Lond., p. xxxiii (1908); Auriv., in Seitz, Macrolep., p. 199 (1913).

Bourbon.

Expanse about 45 mm. Ground-colour dark umber. Paler markings deep yellow. F.-w. with three minute white dots in cell

and three, sometimes four beyond it. A submarginal border consisting of two lines faintly darker than ground-colour, between which are developed minute white dots especially towards the apex. A small hind-marginal spot of deep yellow followed by a large discal spot in 2 and 3, more quadrate than in *frobenia*. A subapical spot made up of patches of nearly equal length in 5, 6, and 8. H.-w. with traces of a hind-marginal border of lighter and darker markings and with a discal band of deep yellow of sharply defined but irregular outline, not more than about 3 mm. wide at its broadest part, deeply concave between the nervules from 1*b* to 4 and projecting suddenly outwards in area 4.

Underside more or less reproducing the pattern of upperside, but ground-colour much paler and f.-w. hind-marginal and subapical spots nearly white, also a whitish transverse mark across end of cell. Hind-wing base with faint indications of pale spots, a curved row of small whitish spots in 4, 5, 6, and 7, followed by the discal band which is white or pinkish, sharply defined on both edges, and distally edged with dark brown followed by a greyish line. Slight indications of a double submarginal row of pale spots. Male with a pearly opalescent area in f.-w. extending from inner margin beyond nervule 2.

The following description of the larva is from Oberthür.

Originally fed on *Trajia reticulata*, but now feeds on *Acalypha marginata*, plants introduced from Mauritius. Larva pale chestnut. Flexed, about 22 mm. long. Six lateral membranous protuberances; the intermediate ones longer and projecting forward like horns. Three sublateral festoons edged with white and above the angle of the festoon white oblique marks. The last festoon rises posteriorly towards the caudal extremity, which ends in four fine points. Underside rose brown. The last segment has a pale shining mark of "arabesque" form. A paler median dorsal line arises from the prothorax and ends well before the caudal extremity.

The chrysalis is angular, short, flattened laterally, and projecting at the alar extremities. Gold pink tending to yellow or cream, opalescent. All the dorsal projections end in green points with a green iridescence. The prominent abdominal lines are touched with gold. The abdominal segments have a gold reflection.

Alleged occurrences of this species elsewhere than in the island of Bourbon seem unreliable. The male clasper resembles that of *comorarum*, but presents small differences which will be noted in the figure.

3. Neptis mayottensis. Pl. XX, fig. 3; Pl. XXIV, fig. 3.

Oberth., Etud. d'Ent., 13, p. 14, pl. 2, f. 10*a*, 10*b* (1890); Auriv., Rhop. Aeth., p. 166 (1898); Poulton, Proc. Ent. Soc. Lond., p. xxxv (1908); Auriv., in Seitz, Macrolep., p. 199, pl. 48*c* (1913).

Mayotte I.

Expanse about 35 mm. Ground-colour dark umber. F.-w. with three white dots in cell and three beyond. A submarginal border of two very slightly darker lines with paler marks between them which are resolved into distinct white dots towards the apex. A deep yellow inner-marginal patch in 1*a* and 1*b* continuous with the h.-w. discal band. A large patch of deep yellow in 2 and 3, and three subapical spots of same colour in 5, 6, and 8, the last very small. H.-w. with a broad dark yellow discal band 4 mm. wide and of regular outline. A submarginal border of two lines darker than ground-colour, the inner line twice the width of the outer.

Underside. Ground-colour paler. F.-w. large spots only slightly yellow, and the white dots accentuated. There are also two yellowish marks in cell and a transverse one at end of same. Traces of a second submarginal series of white dots beyond those which are also visible above. H.-w. irregularly marked in basal area with ill-defined whitish and yellowish spots, the discal band pinkish white and the space between it and hind margin occupied by a border consisting of internervular patches of dark brown shaded to reddish, each patch bounded proximally by a curved, and distally by a straight whitish line. Between the latter and margin a third very fine white line. The male has a pearly opalescent area in f.-w. reaching to nervule 2.

The female is paler and all the white dots more accentuated on both surfaces, so that on the upperside there is a complete submarginal series of these. In the h.-w. the discal band is broader. The male clasper except for its smaller size is very like that of *dumetorum*.

4. Neptis comorarum. Pl. XX, fig. 4; Pl. XXIV, fig. 4.

Oberth., Etud. d'Ent., 13, p. 14, pl. 2, f. 9*a*, 9*b* (1890); Auriv., Rhop. Aeth., p. 166 (1898); Poulton, Proc. Ent. Soc. Lond., p. xxxv (1908); Auriv., in Seitz, Macrolep., p. 199, pl. 48*a* (1913).

Grand Comoro.

comorarum leighi.

Roth., Novit. Zool., p. 341 (1918).

Anjouan I.

comorarum comorarum.

Expanse 35–45 mm. On the upperside this species resembles *mayottensis* with the exception that the f.-w. inner-marginal spot is nearly always absent, though out of some twenty-four examples before me, three or four have a slight trace of it.

The underside is also very similar, but in the male the f.-w. opalescent area extends well into area 2, while the space between the discal and subapical spots is reddish brown. There is also more reddish brown on h.-w., especially near costa.

comorarum leighi.

Differs from the type form in being smaller, the orange spots above paler, and the markings below less sharp and distinct.

The male clasper of the type form differs from that of its immediate allies in the greater development of the upper projection.

5. Neptis saclava. Pl. XXIV, fig. 5.

Boisd., Faune Mad., p. 49 (1833); Lucas in Chenu, Enc. H. N. Pap., p. 132, f. 248 (1853); Trimen, Rhop. Afr. Austr., p. 148, 338 (1862–66); Mab., Hist. Mad. Lep., 1, p. 173, pl. 20, f. 7, 8 (1885); Auriv., Rhop. Aeth., p. 166 (1898); Poulton, Proc. Ent. Soc. Lond., p. xxxv (1908); Auriv., in Seitz, Macrolep., p. 199, pl. 48*c* (1913).

Madagascar.

saclava marpessa. Pl. XX, fig. 5.

Hopff., Sitzb. Akad. Wiss. Berlin, p. 640 (1855); Peters, Reise Moss. Ins., p. 383, pl. 24, f. 9, 10 (1862); Trimen, S. Afr. Butt., 1, p. 272 (1887); Butl., Proc. Zool. Soc. Lond., p. 65 (1888); Auriv., Rhop. Aeth., p. 167 (1898); Butl., Proc. Zool. Soc. Lond., p. 921 (1900); Roth. & Jord., Novit. Zool., p. 536 (1903); Poulton, Proc. Ent. Soc. Lond., p. xxxv (1908); Rogers, Trans. Ent. Soc. Lond., p. 505 (1908); Neave, Proc. Zool. Soc., p. 33 (1910); Auriv., in

Seitz, *l. c.* (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 160 (1920).

= *nemetes* var. *pasteuri*. Snellen, Tijdschr. Ent., xxv, p. 221 (1882).

Africa south of Sahara.

saclava saclava.

Expanse about 45 mm. Ground-colour dark sepia. Three white dots in cell and three or four beyond it. An inner marginal spot in 1*a* and 1*b* which may or may not be contiguous with a large white patch in 2 and 3. In area 4*a* a small distally placed white dot followed anteriorly by three white spots in 5, 6, and 8. These are separated from each other by the ground-colour, especially the first two, and the third on the costa is very small. The hind-marginal border consists of two fine whitish lines and sometimes a third close to the larger white marks, much interrupted at the nervules and broken into small spots. Between these and the large discal spots is a row of darker internervular markings sometimes tipped with white scales proximally. On h.-w. a broad white discal band about 4–5 mm. wide of fairly even outline but slightly, though not very markedly, projecting in area 5. Following the discal band there is a row of rather large more or less rounded dark internervular markings, followed again by two lines of equally dark but much narrower marks.

Underside. The white markings are repeated but in f.-w. the subapical patch is continued right to the costa by the addition of linear marks in areas 9 and 10, and these marks are lemon yellow. The ground-colour is variable and blotchy, reddish in cell and along the nervures, darker above central patch to costa, and at apex and between nervules 3 and 4. Externally adjacent to white markings is a row of dark spots, interrupted in area 5. On h.-w. the base is brownish with irregular pale marks. Distal to the discal band a row of dark internervular spots, proximally edged with white, of which those in 3 and 4 are largest. Beyond these, two rows of transverse internervular dark markings, also edged with white.

Male beneath has a pearly inner marginal area in f.-w. extending to nervule 2. The female also has a similar area, but of much smaller extent and generally hidden in average setting.

saclava marpessa.

This is the mainland form and is generally supposed to be distinguished by its narrower white markings, but I have before me W. African examples with the h.-w. discal

band broader than in the majority of those from Madagascar. The most constant difference between the mainland and the island forms is the marked projection in the former of the h.-w. discal band in area 5.

Saclava is unlikely to be confused with any other species except *nemetes*, but in the latter the subapical spots are coalescent, and the h.-w. discal band is continuous with the f.-w. white markings right up to nervule 4 of f.-w., at least on the proximal side. The male clasper of *saclava* is of the same type as in the yellow marked Madagascar species, though its upper projection is less highly developed. All these species are undoubtedly closely related. An interesting discussion by Prof. Poulton on the forms will be found in Proc. Ent. Soc. Lond., p. xxxv, 1908.

6. Neptis metella. Pl. XX, fig. 6; Pl. XXIV, fig. 6.

Doubl. & Hew., Gen. Di. Lep., p. 272, pl. 35, f. 2 (1850); Holl., Ent. News, 3, pl. 9, f. 3 (1892); Auriv., Rhop. Aeth., p. 166 (1898); Poulton, Proc. Ent. Soc. Lond., p. xl (1908); Auriv., in Seitz, Macrolep., p. 199, pl. 48*c* (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 160 (1920).

S. Leone to V. Nyanza.

metella gratilla.

Mab., Ann. Ent. Belg., 23 Bull., p. 106 (1880); Hist. Mad. Lep., 1, p. 172, pl. 18*a*, f. 7 (1885–7); Auriv., Rhop. Aeth., p. 166 (1898); in Seitz, Macrolep., p. 200 (1913).

Madagascar.

metella metella.

Expanse about 45 mm. Ground-colour dark sepia. Markings white. In f.-w. cell a long prominent streak pointed at base, widest at cell end, projecting beyond, and again reduced to a point. In a few examples this streak is obsolescent. In most specimens there are two small marks just above outer point of cell streak. A small inner-marginal spot of variable size in 1*a* and 1*b*. Two large discal spots in 2 and 3 notably separated by nervule 3. In 4 two small spots, larger ones in 5 and 6, and a very small one in 8. Just distal to spots in 2 and 3, and 5 and 6, a white transverse line, variable and sometimes obsolescent. A hind-marginal border of two white lines variable and generally interrupted in 3.

H.-w. with a broad white discal band followed by dark interner-

vular markings, followed again by two pale lines variable and sometimes white.

On underside the f.-w. is deep yellow at base and for some distance along the costa, the ground-colour pale sepia brown and the white markings of the upperside are repeated but more distinctly. An irregular row of blackish spots beyond the discal white markings. The submarginal white lines, of which there are three, are thickened, and separated only by dark internervular streaks, though more or less completely interrupted in area 3.

H.-w. base yellowish with black spots. The discal band bordered by small internervular black spots followed by a row of larger rounded ones on a yellowish ground, followed again by two narrow black lines on a pale ground.

The male has an inner-marginal pearly white area on f.-w. extending to nervule 2.

metella gratilla.

The Madagascar form seems only to be distinguished by larger white markings, but examples before me from near Lagos are equally remarkable in this respect.

If the numbers received in general collections are of any proportional value *metella* would seem to be comparatively rare. The species cannot well be mistaken for any other with its combination of white streaked cell and h.-w. base beneath yellowish, spotted with black.

If we assume the structure of the male armature to be of value in estimating affinities, all the foregoing species would be regarded as closely allied members of an intergeneric group. They are more easily recognised by their outward characteristics than by the genitalia, which, though all very distinct from those of the rest of the genus, present but small constant differences *inter se.*

7. Neptis nemetes. Pl. XX, fig. 7.

Hew., Exot. Butt., Neptis, pl. 1, f. 1, 2 (1868); Holl., Ent. News, 3, pl. 9, f. 4 (1892); Karsch, Berl. Ent. Zeit., 38, p. 186 (1893); Auriv., Rhop. Aeth., p. 167 (1898); Neave, Proc. Zool. Soc. Lond., p. 33 (1910); Auriv., in Seitz, Macrolep., p. 200, pl. 48c (1913); Holl., Bull. Am. Mus. Nat. Hist., 160 (1920).

S. Leone to Uganda.

nemetes obtusa.

Roth. & Jord., Novit. Zool., p. 536 (1903).

Scheko.

nemetes f. *carpenteri*, f. nov. Pl. XXIV, fig. 7.

Kakindu (W. of V. Nyanza). Semliki Valley. Uganda.

nemetes nemetes.

Expanse 40–45 mm. Sepia black with white markings. F.-w. with a white patch beginning at the inner margin and ending at nervule 4. The four spots constituting this patch are somewhat variable. In some forty examples before me they are always contiguous at least on the proximal side, and their inner edge forms a somewhat concave line continuous with the proximal edge of the h.-w. discal band. The spots in 2 and 3 project distally beyond those in 1*a* and 1*b*. In area 4 there is usually a small spot placed distally, and this is followed by a subapical white patch formed of three contiguous spots in 5, 6, and 9. In many examples there is an irregular, somewhat broken white line about 1·5 mm. from the other white markings and roughly following their outline. Beyond this are two, sometimes three delicate pale lines interrupted at the nervules and in area 3 and at apex. Fringes rather notably white between nervules except in 3 and 6.

H.-w. with a white discal band varying from 3 to 5 mm. in width. Beyond this band a row of rounded internervular spots rather darker than the ground-colour, followed by three pale lines which are in some specimens quite white and distinct. Fringes markedly white between the nervules.

Beneath, ground-colour pale. Costa white at base. In cell a white line running along subcostal nervure and curving over to form a transverse boundary at end of cell. Just beyond this boundary a second fine pale line, and beyond that a third. On median side of cell a short broken line. White patches as on upperside. White lines much more distinct, and irregular dark spots between discal patches and submarginal border lines.

H.-w. base brown with three transverse white lines, the first basal and continuous with subcostal line of f.-w. cell, the second broader and almost continuous with the median line of f.-w. cell, and the third narrow and hardly reaching the costa. Discal white band as above followed by a pale yellowish-brown line on ground-colour and a band of dark well-rounded internervular spots, which are shaded away outwardly, to be followed by a rather broad white line and two narrow ones, all divided by the nervules. Dark spots at nervule ends.

nemetes obtusa.

Messrs. Rothschild and Jordan's description of this form is as follows :—

Costal margin of f.-w. shorter than in *nemetes nemetes*, the wing appearing more obtuse. The white band in both wings much narrower, the inner edge of the band of the h.-w. crossing vein M just at point of origin of M1. Length of f.-w. 21 mm.

nemetes f. **carpenteri.**

There is no quite constant difference between the upper-side of this form and that of *nemetes nemetes*, though in the latter the f.-w. spots in 2 and 3 tend to be longer. Beneath, the ground-colour and all the light markings, except the large white bands and spots, are more yellowish, thus bringing the dark rounded spots into greater prominence. The principal difference, however, is in the base of h.-w. cell beneath, which is not banded with white, but is of a yellowish ground-colour with more or less well-defined black spots.

There is no recognisable difference between the armatures of the typical form and f. *carpenteri*.

Except for the variability of the width and extent of the white markings *nemetes* is a fairly constant and easily recognised species. The only species likely to be confused with it is *N. poultoni*, which, however, can at once be distinguished by the conspicuous curved white costal band at base of h.-w. beneath. The form *carpenteri* seems to be the only one at Kakindu. Wherever it occurs it appears to be accompanied by *metella*, a fact which suggests a mimetic approach to that species in the pattern of h.-w. base beneath.

8. Neptis poultoni. Pl. XX, fig. 8; Pl. XXV, figs. 7, 8.

Eltr., Ent. Mo. Mag., Ser. 3, vol. vii, p. 26 (1921).

Uganda (Chagwe, Mabira Forest).

" Expanse 38–42 mm. Ground-colour dark sepia, with white discal markings. F.-w. with an inner marginal patch in 1*a* and 1*b* the proximal edge of which forms a straight line continuous with that of the h.-w. discal band. In 2 and 3 are large contiguous spots forming a subovate patch of regular outline. In area 4 a minute white dot placed distally. In 5, 6, and 10 contiguous spots forming a large subapical patch. Distal to the white markings and roughly following their contour a line somewhat paler than ground-colour, followed by

a band of more or less rounded dark internervular spots, this followed again by three paler lines forming the hind-marginal border. Fringes dotted white between nervules.

H.-w. with a white discal band of regular outline 4 mm. wide on inner margin, and rather broader in 5, thence narrowing to a small spot in 7. Distal to the white band a border similar to that in f.-w.

Underside. Ground-colour paler than above. Costa white at base and as far as cell end. In cell a white line on subcostal curving downwards and outwards, its end pointing to origin of nervule 3. On end of cell a white transverse line, and beyond this, indications of a second indistinct line. Discal white spots as above, but subapical extends into 10. The border arrangement of pale lines much accentuated owing to increased whiteness of lines and an additional fine marginal line.

H.-w. brown at base, but with a *conspicuous curved white costal bar from base to end of* 8, followed by two indistinct narrow whitish streaks on dark ground. Beyond discal band border of same pattern as in f.-w."

Neptis poultoni closely resembles *nemetes nemetes* Hew. and also, even more closely, *trigonophora* Butl. From *nemetes* it is at once distinguished by the curved white costal band in h.-w. underside, and from *trigonophora* by the underside pattern of the hind margins of both wings. The male armature is unlike that of any other species I have examined. In the note to my original description (*l. c.*) the word "costal" was unfortunately misprinted "distal."

9. Neptis incongrua. Pl. XX, fig. 9; Pl. XXIV, fig. 8.

Butl., Proc. Zool. Soc., p. 112, pl. 6, f. 2 (1896); *l. c.* (1896), p. 826 (1897); Auriv., Rhop. Aeth., p. 169 (1898); Auriv., Sjostedt Exp. Kilimandjaro, p. 6 (1910); Auriv., in Seitz, Macrolep., p. 203, pl. 48*f* (1913).

Dabida Hills. Mombasa. Kikuyu. Taita. Nyassaland. Tanganyika Ter. Lindi.

incongrua occidentalis.

Roth., Novit. Zool., p. 342 (1918).

90 km. W. of L. Albert Edward.

incongrua incongrua.

Expanse about 50 mm. Sepia black with white markings. F.-w. with two small hind-marginal spots in 1*a* and 1*b* separated by the nervure. Two spots in 2 and 3, the upper one the smaller. A subapical row of three spots, the first in 5, rounded, the second in

6, subquadrate, the third in 8, very small. Three small dots beyond cell. (One example in the Hope Dept. has an additional discal spot in area 4.)

H.-w. with a discal band of white spots about 3 mm. wide at broadest part extending from inner margin to area 6, the spots progressively more separated, that in 6 being small and rounded. Fringes of both wings white between nervules.

Underside chestnut brown. F.-w. without spots in cell, but with three small dots beyond it. Spots as on upperside but less separated, the two upper spots of subapical row fused together with an additional streak in 9. In male a pearly inner marginal area extending to nervule 2.

H.-w. with discal band as above, but more continuous and edged with sepia. Extreme margins and all nervures especially in h.-w. black. No internervular rays.

incongrua occidentalis.

Ground-colour greyer than in the type form. All the spots of f.-w. discal band wanting except those on each side of 1, 3, and 6, and these are much smaller. H.-w. band narrower. Both above and below there are dark internervular rays. Beneath the disc of f.-w. and outer fifth of h.-w. much deeper rufous.

Neptis incongrua is quite unlike any other species except *swynnertoni*, from which it differs in having smaller white marks and no spots in f.-w. cell.

I have examined the type of *incongrua occidentalis*, and though the great reduction of the white spots gives it a characteristic appearance, the male armature seems to resemble that of the type form within the limits of individual variation.

10. Neptis woodwardi. Pl. XX, fig. 10; Pl. XXIV, fig. 9.

Sharpe, Ann. Nat. Hist., (7) III, p. 243 (1899); Poulton, Trans. Ent. Soc., p. 512, pl. xxix, ff. 1, 2, 3, 4 (1908); Auriv., in Seitz, Macrolep., p. 203 (1913).

Uganda.

Expanse about 45 mm. Sepia brown with yellow and white markings. F.-w. with two spots in 2 and 3 which may be ochre yellow or white, and small subapical spots in 5, 6, and 8, the last very small. These are generally white.

H.-w. with a discal band of ochre yellow 3–4 mm. wide, rarely white, beginning just below nervule 2 and ending in 6. Fringes of both wings white between nervules.

Underside ochreous, brownish over central area in f.-w. and near apex of h.-w. Spots of f.-w. as above, but white and with an additional streak in 9. H.-w. discal band as above, sharply defined. In both wings fine dark internervular rays which are also visible above.

The colour of the lighter markings in this species is extremely variable. In some examples they are all white, but this appears to be due to fading. It is easily distinguished from all other species in so far as pattern is concerned, though the male clasper is doubtfully distinguishable from that of *ochracea*.

As Prof. Poulton has pointed out (*l. c. supra*) examples from E. of the Rift Valley show a greater mimetic approach towards *Amauris*, than specimens from more westward localities. The figures quoted should be referred to on this interesting point.

11. Neptis ochracea. Pl. XX, fig. 11; Pl. XXIV, fig. 10.

Neave, Novit. Zool., 11, p. 330, pl. 1, f. 5 (1904); Auriv., in Seitz, Macrolep., p. 203 (1913).

Toro. Entebbe. Kakindu.

ochracea f. *ochreata*.

Gaede, Int. Ent. Zeit. Guben, 9, p. 38 (1915).

= *exaleuca* var. *ochracea*. Grünb., Ergeb. Deut. Cent. Af. Exp. F. von Mecklenberg, 1907–8 (1912).

= *ochracea parvimacula*. Roth., Novit. Zool., p. 341 (1918).

Kwidgwi (L. Kivu).

ochracea f. *milbraedi*.

Gaede, *l. c.*, 9, p. 38, pl. 1, f. 3 (1915).

N. Cameroon.

ochracea ochracea.

Expanse 40–50 mm. Ground-colour dark to medium sepia brown with orange to pale ochreous areas. F.-w. with a broad patch of ochreous from inner margin to area 3, and a subapical patch of two subquadrate spots of the same colour in 5 and 6, sometimes followed by a small spot near costa. H.-w. with a broad ochreous discal band reaching to origin of 2, its proximal edge forming a continuous but not very regular line with that of the f.-w. inner marginal patch. Nervules and rays dark.

Underside pale dull ochreous, rather darker over basal half of f.-w. Paler marks as above, but h.-w. discal band reaches practically to base and is ill defined distally except in very dark specimens. Nervules and internervular rays well marked.

ochracea f. **ochreata.**

Differs from the type form in having the yellow bands narrower and the f.-w. discal band is interrupted in 1*b*. I have examined an example of the armature of Lord Rothschild's *parvimacula* and it is the same as that of *ochracea*. I cannot discover any difference in outward characters between forms *ochreata* and *parvimacula*, and both are described from the same locality.

f. **milbraedi.**

Differs from the type form in having the yellow bands rather broader and the costal spot wanting in f.-w. This latter point is no real distinction, as otherwise typical forms are without the spot.

The resemblance of *ochracea* to *exaleuca* in all but colour is very remarkable, and it is tempting to regard them as forms of the same species; nevertheless, although the armature of *exaleuca* is variable, I have not found an example approaching agreement with that of *exaleuca*.

12. Neptis exaleuca. Pl. XX, fig. 12; Pl. XXIV, fig. 11.

Karsch, Berl. Ent. Zeit., 39, p. 9, f. 5 (1894); Auriv., Rhop. Aeth., p. 169 (1898); Auriv., in Seitz, Macrolep., p. 202 (1913); Holl. (*Neptidomima*), Bull. Mus. Am. Nat. Hist., p. 164 (1920).

Cameroon. Congo.

exaleuca suffusa.

Roth., Novit. Zool., p. 341 (1918).

95 km. W. of L. Albert Edward (3250 ft.).

exaleuca f. *integra*, f. nov.

Toro.

exaleuca exaleuca.

Expanse 45–50 mm. Ground-colour dark sepia with white markings. The description of the upperside of *ochracea* applies to this species if we substitute white for ochreous patches, and add that there is a break in the inner-marginal patch in area 1*b*. The

pale marks are somewhat smaller than in *ochracea* and distally more sharply defined. Beneath, the ground-colour is pale sepia, but the base of both wings is orange ochreous, and the h.-w. band is very sharply defined, being bounded distally, especially as far as 3, by a fine line darker than the ground-colour.

exaleuca suffusa.

Ground-colour is much darker and the f.-w. patches on each side of 1 and 3 much smaller. The underside is strongly marked with rufous orange.

The male clasper of *exaleuca* is of a very unstable pattern. It differs from that of *ochracea* in the form of the projection on the upperside of the clasper. In *woodwardi*, *ochracea*, and *incongrua* this is extended into a prominent upward and backwardly curved hook. In *exaleuca*, of which I have made several preparations, the hook is very small in one example. In another there is one very small hook on the left clasper and two on the right. In none of my preparations is there any approach to the great development of the hook found in the other species or in *nemetes*. The armature of *exaleuca suffusa* is somewhat intermediate to that of *ochracea* in having a slight development of the upturned hook, but the claspers of *exaleuca suffusa* are not more different from those of *exaleuca exaleuca* than different examples of the latter are from each other.

exaleuca f. **integra.**

Differs from typical *exaleuca* in having no definite interval of ground-colour between spot in f.-w. 1*a* and that in 2. The male clasper is of the same type as those of the typical form.

13. Neptis swynnertoni. Pl. XXI, fig. 1; Pl. XXIV, fig. 12.

Trim., Proc. Ent. Soc. Lond., p. xxviii (1912).

S. E. Rhodesia (Mt. Chirinda).

subsp. *neavei*.

Roth., Novit. Zool., p. 342 (1918).

Nyassaland (Mt. Mlanje).

swynnertoni swynnertoni.

Expanse 40–50 mm. Ground-colour sepia black, with white

markings. F.-w. with three small white spots in cell and four beyond it. A very small inner marginal spot not always extending beyond 1*a*. A large patch of two spots in 2 and 3, its proximal and distal margins forming nearly parallel lines at right angles to the costa. A rounded spot in 5, a subquadrate in 6, and a very small spot in 8.

H.-w. with a discal white band about 5 mm. wide beginning about middle of inner margin and ending, considerably reduced in width, in area 6. All fringes white between nervules.

Underside chestnut brown. White markings as above, but with an extra subapical spot on costa. The h.-w. discal band outlined with darker colour.

The principal distinction between this species and *incongrua* is the presence of white spots in the f.-w. cell, and the large coalescent spots in f.-w. 2 and 3. Whilst the external characters suggest a very close relationship to *incongrua*, the male clasper is so different from that of the other species of the group as to suggest only a very slight affinity. That the clasper of *incongrua* should present a far closer resemblance to that of *nemetes* than to that of *swynnertoni* is a good example of the difficulties presented by this genus.

Trimen (*l. c.*) regards this species together with *incongrua*, *exaleuca*, and *woodwardi* as allied to the Palaearctic species *lucilla* Fab.

swynnertoni neavei.

Whilst the type of this form in Lord Rothschild's collection differs in certain small points from the few examples of *swynnertoni* we have at Oxford, examination of a small series of Mlanje specimens in the national collection shows that such differences are not constant. Perhaps the least inconstant feature is the absence of well-marked internervular rays on the h.-w. underside in *neavei*.

I strongly suspect that when Lord Rothschild described *neavei* he had not seen an example of *swynnertoni*, otherwise he would not have compared it with *exaleuca*, with which it has little in common. Indeed, it is difficult to separate *neavei* from *swynnertoni* on any outward character, but the fact remains that the male armatures are different, at least according to the few preparations I have been able to make from these rare forms.

The clasper of *swynnertoni* is shown at Pl. XXIV, fig. 12. Those of examples from Mlanje (= *neavei*) differ in having an upturned hook at the extremity, somewhat like that of

ochracea, though less developed. My friend Dr. S. A. Neave tells me that the fauna of Chirinda and Mlanje present great similarities, and the explanation of the present case seems a simple one. The same species, *swynnertoni* has become isolated in the two elevated regions. On Mlanje the clasper has developed an upturned hook. Doubtless in course of time other modifications will arise, and what are now probably forms of the same thing will ultimately become two definitely separate species.

14. Neptis agatha. Pl. XXI, fig. 2; Pl. XXIV, fig. 13.

Stoll, Cramer Pap. Exot., 4, p. 76, pl. 327, f. A, B (1780); Hopffer, Peters Reise Moss. Ins., p. 383 (1862); Staud., Exot. Schmett., 1, p. 146, pl. 50 (1885–6); Trim., S. Afr. Butt., 1, p. 270 (1887); Karsch, Berl. Ent. Zeit., 38, p. 186 (1893); Auriv., Rhop. Aeth., p. 167 (1898); Roth. & Jord., Novit. Zool., p. 536 (1903); Rogers, Trans. Ent. Soc. Lond., p. 505 (1908); Neave, Proc. Zool. Soc., p. 33 (text fig.) (1910); Auriv., in Seitz, Macrolep., p. 200, pl. 48*d* (1913); Longstaff, Trans. Ent. Soc. Lond., p. 21 (1913); *l. c.* p. 275 (1916); Holl., Bull. Am. Mus. Nat. Hist., p. 160, pl. vi, ff. 7, 8 (1920).

= *melicerta*. Fab., Syst. Ent., p. 508 (1775); Godt., Enc. Meth., 9, p. 432 (1823); Trim., Rhop. Afr. Aust., p. 146 (1862).

= *agathe*. Herbst, Naturs. Schmett., 9, p. 86, pl. 238, f. 7, 8 (1798).

Africa S. of Sahara.

agatha ab. *lativittata*.

(*N. lativittata*) Strand, Archiv. f. Naturg., 75, 1, p. 305 (1909).

With type form.

agatha agatha.

Expanse 35–50 mm. Sepia black with white markings. F.-w. with three to four or five dots in cell. A hind-marginal patch of two spots in 1*a* and 1*b*, a discal band of spots from 2 to costa, sometimes quite continuous, sometimes interrupted slightly by nervules, the outer edge forming a fairly regular convex curve, the inner straighter but usually indented at nervule 4. Distal to this band a line rather paler than ground-colour and sometimes bearing a few white scales,

this followed by three lines of transverse internervular white streaks interrupted by the nervules and more completely broken (very rarely unbroken) in area 3. Fringes of both wings white between nervules.

H.-w. with a white discal band of variable width, but usually about 5 to 6 mm. extending from middle of inner margin to area 6. Beyond this the ground-colour rather paler, then darker, and finally a submarginal border of three fine white lines, broken only by the nervules.

Underside. Sepia brown. F.-w. white at base of costa, a variable series of spots in cell and two or three beyond it. Discal band as above, but rather broader. The pale line beyond it broader than above, but more diffuse. The white marginal lines much more pronounced, the first expanded into triangular spots near apex. Often a fourth line along hind margin. Interruption in area 3 sometimes complete, sometimes scarcely evident.

H.-w. with a white costal band, followed by two others, the first of which travels well along costa where it is broken into spots. Pale line beyond the discal band often with a slightly ochreous appearance. First (proximal) submarginal line much widened, all more distinct than above, and often a fourth line at margin.

agatha lativittata.

The white markings of more than average extent.

Neptis agatha is by far the commonest and most widely distributed species in the African region. The species with which it is liable to be confused are *jordani*, *livingstonei*, *barnsi*, and *seeldrayersi*. No absolutely constant characters can be given to distinguish *jordani*, but its characteristics so far as they can be described will be found under that species. The form *livingstonei* is unknown to me. The published figure shows the h.-w. discal band extending only to area 5, and this seems to be the principal distinction. The two species *barnsi* and *seeldrayersi* are distinguishable by small features thereunder described. It is unfortunate that the interruption of the f.-w. submarginal lines in area 3 is not an absolutely constant character, some examples referable to the *lativittata* form having practically continuous lines. This condition is, however, rare and the interrupted lines will almost always serve to distinguish *agatha* from the other species named, with the exception of *jordani*, which also has this feature. Holland (*l. c.*) points out that there is generally a difference between

examples taken in woodlands and those from more open country, the latter being smaller and having a broader white band.

For the sake of completeness I should mention here a form provisionally named *urungensis* by Strand (Mitt. Zool. Berl. V. p. 287 (1911)), and placed by Aurivillius as a form of *nysiades* (Macrolep., p. 201 (1913)). Strand mentions (*l. c.*) two examples resembling Neave's *conspicua*, one of which is distinguished from typical *conspicua* in having well-defined white dots in cell on upperside. The remainder of the description is quite useless as a means of identification, and the author states that should it prove to be a definite form he proposes the name *urungensis*. In my opinion this kind of half-description and provisional nomenclature should not be valid as founding a name of any kind. If the example in question has distinct white dots in cell it certainly cannot be a form of *conspicua*. I place it here merely because it suggests, though only vaguely, something allied to *agatha*.

15. Neptis jordani. Pl. XXI, fig. 3; Pl. XXIV, fig. 14.

Neave, Proc. Zool. Soc. Lond., p. 33, pl. 2, f. 1 (and text fig.) (1910); Auriv., in Seitz, Macrolep., p. 200, pl. 48*d* (*agatha* ab.) (1913); (?) Holl., (as *agatha*) Ent. News, pl. 9, f. 2 (1892).

Chishi I. (L. Banguelo). Katanga (Kambove). Boussa (Kassai R.). Aruwimi. Nyassa. Victoria Falls.

A detailed description would follow so closely that of *agatha* that it would seem of more use to state as fully as possible the directions in which it differs from that species. I have before me a series of thirty-six examples. In general appearance the ground-colour is browner than *agatha*. The f.-w. discal band is very complete and shows no blackening at the nervules. In practically every case the white spot in area 4 is longer than that in area 5, whereas in *agatha* 4 is generally shorter than 5. In *jordani* the white in 6 is so markedly shorter than that in 5 that the whole band has a narrowed appearance towards the costa, an effect much less apparent in *agatha*. The distal margin of the discal band from nervule 4 to the costa presents on the whole a straight or even concave line, whereas in *agatha* such margin is convex. In h.-w. the white of the discal band projects outwardly between the nervules, especially in 4 and 5, and the ends of such projections are well rounded. In *agatha* the ends of the

component white spots are generally cut off nearly straight, and they are not liable to so prominent a projection in 4 and 5. This feature is perhaps even more evident on the underside.

This species was noted in the field by Dr. Neave as being apparently distinct from *agatha*. He states that it was decidedly local, frequenting hot dry localities, and having a more restless, active, and less floating flight.

16. Neptis livingstonei.

Suffert, Iris, 17, p. 126, pl. 3, f. 10 (1904); Auriv., in Seitz, Macrolep., p. 200 (1913).

E. Africa (Lukuledi).

Suffert's description is as follows :—

Length of body 16 mm. Expanse 44 mm. Body blackish above, grey below. Upperside. Ground-colour grey black, markings white. F.-w. discal band formed of six spots in 2–6 and 9, proximally fairly straight and sharply defined from the ground-colour. Distally curved and not well defined. At nervule 4 on both sides an indentation, the nervule very black and slightly dividing the band. An inner marginal spot in 1*a* and 1*b*, 6 mm. wide at margin, rounded anteriorly, rather nearer the margin than the base. Three round dots in cell and two elongated spots at cell end. Four transverse submarginal lines, the first—counting from base outwards—just beyond discal band, very diffuse, formed of obsolescent whitish spots, the second consisting of eight more distinct white streaks broadly interrupted by the ground-colour, the third of eight narrow loosely connected streaks, the last very slender and scarcely recognisable. Fringes black, white between nervules.

H.-w. with a discal band of seven spots in 1*a* to 5; proximal edge well defined, the distal in 1*a* to 2 also well defined, in 3 to 5 suffused. The two first lines very indistinct, rather showing through from beneath, the third narrow, in 1*c* to 6 distally rounded, the outermost also narrow and closely approximated. Fringes black, white between nervules.

Underside. F.-w. ground-colour and markings generally as above, with the exception of the cell which shows seven spots, and four dots in base of 4 to 6 and 10, between cell end and discal band. The four submarginal lines heavier than above.

H.-w. discal band and lines as above, latter more distinct. Three basal bands, the first extending along costa to middle of 8. The second from inner margin to base of nervules 7 and 8 and extending slightly into area 7, the outermost from 1*a* at inner margin through

cell a little above base of nervules 5 and 6, into area 5; at end of this band a small spot in the same area.

I have found no example of this form amongst the hundreds of specimens examined. The description and figure suggest a rather aberrant example of *jordani*, though without an examination of the male armature it is impossible certainly to determine its specific identity.

17. Neptis nebrodes. Pl. XXI, fig. 4; Pl. XXIV, fig. 15.

Hew., Ent. Mo. Mag., 10, p. 206 (1874); Holl., Ent. News, 3, pl. 9, f. 1 (1892); Auriv., Rhop. Aeth., p. 169 (1898); in Seitz, Macrolep., p. 202 (1913).

S. Leone. Lagos. Ogowe. Angola. Cameroon.

Expanse 55–60 mm. Sepia brown with white markings. Upperside; f.-w. with an elongated white mark in cell, sharply pointed at base, widest at cell end, and extending into area 4 to within about 1 mm. of the discal spot in 3, where it is narrowed again and comes to a rather indefinite termination. Just above origin of nervule 3 this cell streak has a slight indentation on its costal side. In the majority of examples a minute white spot close to costa near the middle of its length. A small rather elongated inner-marginal patch formed of two spots in 1*a* and 1*b*, followed by two large subquadrate spots in 2 and 3 just separated by nervule 2, and outwardly rather divergent. In 4 a small triangular spot or streak distally placed. In 5, 6, and 9 elongated rather divergent spots, the last very small. Distal to this series of markings a pale line roughly following their contour and interrupted at the nervules. Following this a series of three pale submarginal lines, the first often rather well marked, and all interrupted by the nervules. Fringes of both wings white between nervules.

H.-w. with a well-defined white discal band 5–6 mm. wide, from middle of inner margin to area 6, where it is much narrowed. Close to the distal edge of this band a pale ill-defined line about 1 mm. wide, followed by three pale submarginal lines, the first suffused and about 2 mm. wide, the second very narrow and better defined, the last still narrower.

Underside. Ground-colour rather paler. F.-w. white at base of costa. Cell almost entirely filled with white, and a very small streak at origin of 5 and 6. The indentation in the costal side of the cell mark noted above, here contains a small white dot. Some white scales in base of area 3, several small streaks above cell end. White discal marks as above. Remaining lines much more distinct than on upperside.

H.-w. Base ground-colour with a white costal mark about 4 mm. long, followed by two curved white bands which coalesce near origin of 6. Discal band as above followed by broken whitish line which curls inwards in area 6 and follows costa for some distance. Three submarginal lines as above, but the innermost widened out into a band of large subquadrate spots, the second about 1 mm. wide, and the third very fine, all quite white.

The most distinctive feature of this species is the indentation of the white cell mark, and especially the white dot therein on the underside. Perhaps this character alone is sufficient to distinguish it from other described species.

18. Neptis jamesoni. Pl. XXI, fig. 5; Pl. XXIV, fig. 16.

Godm., Story of the Relief Expedt., p. 436 (1891); Auriv., Ent. Tidskr., 15, p. 283 (1894); Rhop. Aeth., p. 169 (1898); in Seitz, Macrolep., p. 202, pl. 48*f* (1913).

Lagos. Cameroon. Congo Region.

Expanse 55–65 mm. Sepia black with white and blue-grey markings. F.-w. with a large white mark in cell pointed at base and wide at end of cell, beyond which is a terminal patch of pale blue grey (sometimes separated). The extreme base of the white mark and as far as origin of nervule 2, also blue grey. A large white inner-marginal mark consisting of two spots in 1*a* and 1*b*, about 6 mm. long and slightly separated distally. A subtriangular mark in 2 rather distally placed and separated, especially outwardly, from a longer quadrate spot in 3. In 4 a small distal triangular spot, and a subapical series of three elongated spots distally divergent in 5, 6, and 9. Beyond this discal series a delicate line of whitish or blue-grey scales, interrupted at nervules, followed by two similar submarginal lines, the first the more distinct. Fringes of both wings white between the nervules.

H.-w. with white discal band about 6 mm. wide narrowing where it ends in area 6. Near it, distally, a pale line, and beyond it two, sometimes three submarginal lines, the first often distinctly white, the others very narrow and sometimes rather indistinct.

Underside. Ground-colour only little paler than above. F.-w. white at base on costa. Cell with a large pyriform mark cut off rather suddenly at cell end, and immediately followed by a white transverse mark, and a second more or less crescentic spot at base of area 4. Two or three small streaks near costa above end of cell. Other white marks as above but more accentuated. No blue-grey scales. First line beyond discal spots well marked but less pure white than the rest. An additional fine line at margin.

H.-w. with a narrow white costal band from base to rather b
middle of costa, followed by two white bands the second
broken and irregular. Discal white band as above followed
narrow brownish-white line which curves inwards at 6 and tr
proximally to join the costal band. The submarginal lines m
more distinct than above, the innermost some 2 mm. wide and w
defined.

I have seen but few examples of this species. The blue-grey marks in cell will usually suffice to distinguish it from other forms. It can be distinguished from *nebrodes* by the absence of the anterior notch in f.-w. cell mark, and from *lermanni* by the more elongated divergent f.-w. subapical spots.

19. Neptis lermanni. Pl. XXI, fig. 6; Pl. XXIV, fig. 17.

Auriv., Öfvers. Vet. Akad. Förhandl., 53, p. 431 (1896); Rhop. Aeth., p. 168, pl. 1, f. 8 (1898); in Seitz, Macrolep., p. 202, pl. 48*f* (1913); Holl., Bull. Am. Mus. Nat. Hist. p. 164 (1920).

Congo Region.

Expanse 50–60 mm. Ground-colour dark sepia with white markings. F.-w. with a large white pyriform mark in cell. This mark is generally rather ill defined, not always extending to base, where, however, the ground-colour is generally dusted with blue-grey scales, some of which are also found at the distal end of mark. Beyond this at base of area 4 an ill-defined spot largely composed of pale-grey scales. An inner-marginal patch of two spots in 1*a* and 1*b*, two subovate spots in 2 and 3, separated by nervules, a small triangular spot distally placed in 4, three spots in 5, 6, and 9 slightly separated by nervules and shorter than in *jamesoni*. Following these discal marks a pale line interrupted by the nervules, and three more or less white submarginal lines.

H.-w. with a discal white band about 6 mm. wide from inner margin to area 6, where it is rounded off and narrower. Distal to this a pale line, and three submarginal lines as in f.-w.

Underside little paler than above. F.-w. white at base of costa. Cell mark more fully developed, though tending to an invasion of the ground-colour along basal part of median. Just distal to end of cell mark a curved transverse line followed by a small ill-defined spot, and above this faint traces of small spots near costa. White discal marks as above, that in 4 not more developed than on upperside. Submarginal border lines well developed, and traces of an extra line at margin.

H.-w. with white at base extending as a fine line to middle of costa, followed by a white band incompletely divided into two. Discal band as above followed by a brownish white line which curves round at 6 to meet costal line. Submarginal lines well developed, especially the innermost, which forms a band some 2·5 to 3 mm. wide broken only by the nervules.

Judged both by the pattern and the structure of the male armature *lermanni* is very closely allied to *jamesoni*. From the few examples I have seen the ground-colour is rather browner, and the fore-wing cell mark is without the well-developed distal patch of blue-grey scales. The species is extremely rare in collections.

The six foregoing species all have the male clasper of a form characterised by a single pointed projection (in *jordani* there is an additional inwardly directed point not visible in the figure). The external patterns do not support the view that these species are more closely allied than others of the genus. Indeed, as we shall see, there are other species whose patterns appear to be much more closely allied to that of *agatha*, but of which the male armatures are of a totally different form.

20. Neptis seeldrayersi. Pl. XXI, fig. 7; Pl. XXV, figs. 5, 6.

Auriv., Ent. Nachr., 21, p. 379 (1895); Rhop. Aeth., p. 167, pl. 1, f. 7 (1898); Auriv., in Seitz, Macrolep., p. 200, pl. 48*d* (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 161 (1920).

Kumasi to Mombasa.

Expanse 45–60 mm. Sepia black with white markings. F.-w. with three white spots in cell and from one to five beyond it. An inner-marginal patch formed by two spots in 1*a* and 1*b*, usually coalescent, or at most only divided by the nervule. A discal band of white spots in 2 to 6 and 9. This band may be quite continuous, with the nervules only just visible, or it may be distinctly separated into spots, distally somewhat divergent. The tendency to separation is greatest on nervule 4, but the spot in 4, though it may be narrow, is not appreciably reduced in length (differing in this respect from *rogersi* and *barnsi*). Distal to the discal band and following its contour a pale line well marked or faint, not thrown into distinct arches between the nervules. Three submarginal lines, the first

more or less expanded into spots near apex (rarely traces of a fourth near apex). These lines, however faint, are interrupted only by the nervules and never markedly obsolescent in area 3.

H.-w. with a white discal band beginning at inner margin and usually ending in area 6, but sometimes extending into area 7. Its proximal margin forms an almost continuous straight line with the f.-w. inner-marginal patch as far as the median nervure, whence it turns downwards towards the anal angle. This discal band varies in width from 4 to 10 mm. and may be quite continuous, even the nervules being white, or it may consist of spots separated by black nervules, and distally still more so by invasions of the ground-colour. Beyond this band a pale line often only faintly indicated, followed by three, sometimes four submarginal lines. Both wings with white spotted fringes.

Underside. Ground-colour little paler than above. F.-w. white at base of costa. Pattern in cell variable but usually consisting of a white mark on subcostal side with a small proximal and a larger distal posterior projection, between which are two rather faint spots. Following this an irregular line across end of cell. Several small spots above cell end. White discal marks as above, the first line yellowish white, the submarginal lines much accentuated, the most proximal one being widened into subtriangular spots towards apex.

H.-w. with a conspicuous white basal band extending along costa nearly to middle of its length, followed by two rather well-defined white bands. These are much more regular and less broken than in *agatha*. Discal band as above. First pale line well developed and yellowish white. Submarginal lines similar to those on f.-w., the most proximal being expanded into subquadrate spots.

There seems no absolutely constant character by which *seeldrayersi* can certainly be distinguished from *agatha*. The most useful is the continuity of the submarginal lines on the upperside of the f.-w. All examples of *seeldrayersi* seem to be constant in this respect, though rare specimens of *agatha* seem also to have uninterrupted lines. When this occurs in *agatha* it seems to be accompanied by a much paler ground-colour, whereas *seeldrayersi* is nearly always very dark sepia to black. The regularity of the white bands on the base of h.-w. underside is also a useful feature, these in *agatha* being almost always broken and irregular.

N. seeldrayersi is not very rare in collections but is frequently overlooked owing to its resemblance to *agatha*,

amongst long series of which a few examples may often be discovered.

21. Neptis barnsi. Pl. XXI, fig. 8; Pl. XXIV, fig. 18.

Eltr., Ent. Mo. Mag., Ser. 3, vol. vii, p. 27 (1921).

Congo Region to Semliki Valley. Kisumu.

"Expanse 55–60 mm. Ground-colour sepia black with white markings. Five white dots in cell of fore-wing, and traces of two minute dots beyond. An inner-marginal white patch of two elongated spots in 1*a* and 1*b*, their proximal edges straight, outer ends slightly separated. In 2 and 3 two white marks, proximally just separated by nervule 3, but distally more widely divergent. In area 4 an obsolescent white streak (in some co-types well developed). In 5 and 6 elongated spots divided by nervule 6 and distally divergent. A small spot in 9 near costa. Distal to white markings and roughly following their contour a fine line of bluish-grey scales which is thrown into a series of arches between the nervules. Following this, three bluish-grey lines continuous except at the nervules. Fringes spotted white between the nervules.

"Hind-wing with a discal white band about 5 mm. wide, rather narrower at inner margin, slightly projecting proximally at median, and extending to area 6. Distal edge of band indented on nervules by the ground-colour and slightly powdered with black between. Three bluish-grey submarginal lines as on fore-wing, and midway between the innermost of these and the discal band a narrow line somewhat paler than the ground-colour.

"Underside. Ground-colour paler than above. Fore-wing costa white at base and nearly to cell end. In cell a series of rather complicated white markings, consisting of a basal streak terminating in a spot, a transverse streak, two small spots, and two at each cell end. Beyond this, three or four very small spots. Large white marks as on upperside, that in 4 more fully developed, the pale lines all much more accentuated but white, not bluish-grey, and there is a trace of an additional fine line at and below the apex.

"Hind-wing with a large curved white costal band from base nearly to end of 8, followed by two less definite white bands on the brown ground-colour. Discal band as on upperside, and rest as on fore-wing."

This species closely resembles *seeldrayersi* Auriv., from which it may generally be distinguished by the obsolescent character of the streak in fore-wing area 4, and by the fact that the pale line on fore-wing immediately distal to the

discal markings is deeply arched (distally convex) between the nervules. The male armature is quite distinct from that of any other described species.

22. Neptis rogersi. Pl. XXI, fig. 9.

Eltr., Ent. Mo. Mag. Ser. 3, vol. vii, p. 29 (1921).

Rabai.

"Expanse about 50 mm. Sepia black with white markings. Fore-wing cell with three or four white dots and three beyond it. An inner-marginal white patch of two spots in 1*a* and 1*b*. Two large subquadrate spots in 2 and 3 separated proximally by the nervule, and distally by a slight invasion of the ground-colour. In 4 a small subtriangular spot, distally placed. Three subapical spots in 5, 6, and 9, the first two subquadrate, distally divergent, and the third a small streak. Just distal to the white discal marks a white line roughly following their contour. This line is not arched between the nervules. Following this, two fine submarginal lines with faint indications of a third, the first breaking into three small but rather conspicuous spots near the costa.

"Hind-wing with a white discal band 7–8 mm. wide, straight, and sharply defined proximally, regular but invaded by the black nervules distally. The outer edge of the band is closely followed by a pale line, and there are three more pale lines forming a marginal border. Fringes white between nervules.

"Underside. Not markedly paler than above. All the lighter markings chalky white. Fore-wing with white at base of costa and a complicated pattern of lines and spots in cell. In the type form there is in the cell a line along the subcostal having two downward projections, between which is a small spot. Just beyond end of this line another spot, and on the median side three spots, one longitudinal and two transverse. Four or five small spots beyond cell. (In the co-type two of the spots coalesce to form a transverse line across cell end.) The spot in 4 is very little larger beneath than above, but more sharply defined and definitely triangular. The discal and submarginal lines are broader and more distinct, only separated by fine dark lines.

"Hind-wing with a curved white costal band, but this much narrower than in *barnsi* and *seeldrayersi*. This followed by two very distinct curved white bands. White discal band very broad and extending from inner margin to area 7. Other lines as on fore-wing."

I hesitate to describe a species from ♀♀ only, but the

two examples from which the above account is compiled do not correspond with any other forms in the collections which I have examined. They are at once distinguished from *agatha* and *seeldrayersi* by the small spot in fore-wing area 4, whilst they differ from *barnsi* in the straight formation of the fore-wing discal line bordering on the large white spots. Also in the much narrower hind-wing basal costal band and in the pure white markings of the underside.

23. Neptis kikideli. Pl. XXI, fig. 10; Pl. XXV, fig. 1.

Boisd., Faune Mad., p. 50 (1833); Mab., Hist. Mad. Lep., 1, p. 171, pl. 20, ff. 9, 10 (1885–7); Trim., S. Af. Butt., 1, p. 271 (1887); Auriv., Rhop. Aeth., p. 167 (1898); in Seitz, Macrolep., p. 200, pl. 48*d* (1913).

Madagascar.

Expanse 30–57 mm. Sepia black with white markings. In f.-w. three dots in cell and sometimes one to four beyond it. A large discal white patch extending from inner margin to nervule 4 and of variable outline. In area 4 a small spot distally placed, sometimes absent. A subapical patch of three or four spots in 5, 6, and 9 or 5, 6, 8, and 9. Discal and submarginal lines extremely variable and generally obsolescent in areas 3 and 6. Fringes of both wings white between nervules.

H.-w. with a broad white discal band 6–11 mm. wide, the proximal margin of which is continuous with the f.-w. inner-marginal patch. This band extends from inner margin to area 7 or even to costa. Distally it may be of smooth outline or indented at nervules; in the latter case the internervular white marks are well rounded. Discal and marginal lines variable, sometimes scarcely evident.

Underside. Ground-colour rather paler. F.-w. white at base of costa. Cell very irregularly spotted with white, and three or four spots beyond it. White marks as above but larger. The pale discal line little developed or absent. The first submarginal widened into a band of spots conspicuously interrupted in 3 and 6.

H.-w. with a white streak at base of costa extending to end of discal band. Discal band as above. The first marginal line expanded into a row of spots and followed by one and sometimes two narrow lines.

This species may be recognised by the fact that the white markings are continuous from inner margin to nervule 4. Also it is confined to Madagascar, where it is apparently not uncommon.

It is a remarkable fact that the male armature is not constantly distinguishable from that of *trigonophora*, a species to which it bears no close resemblance.

24. Neptis trigonophora. Pl. XXII, fig. 1; Pl. XXV, fig. 2.

Butler, Ann. Nat. Hist., (5), 2, p. 177 (1878); Auriv., Rhop. Aeth., p. 169 (1898); Butler, Proc. Zool. Soc. Lond., p. 913 (1900) (? *lermanni*); Auriv., in Seitz, Macrolep., p. 201, pl. 48*e* (1913).

E. and S. Africa (Rabai to Pondoland).

Expanse 45–50 mm. Sepia black with white markings. F.-w. without white dots, but sometimes with vestiges of a longitudinal streak. An inner-marginal patch in 1*a* and 1*b*, followed by two spots in 2 and 3 slightly separated distally. In 4 a very small spot distally placed, and in 5, 6, and 9 three white spots distally separated, the third very small and streak-like. A pale discal line following the contour of the discal spots. Three delicate but usually well-defined submarginal lines.

H.-w. with a white discal band from inner margin to area 7, straight proximally and very slightly indented distally at nervules. This followed by a pale discal line and three, sometimes four submarginal lines, the innermost of these brownish, the rest extremely fine and scaled with white.

Underside. F.-w. very slightly white at base of costa, a curved clavate white mark in cell, its distal end often bordered by a delicate pale curved transverse line. Beyond this four rather ill-defined spots. White discal marks as above, followed by a well-developed pale line of a yellowish tinge and four white submarginal lines, the first about 1 mm. wide.

H.-w. with a small narrow white streak at base of costa, followed by two curved well-defined white lines. Discal band as above followed by a yellowish line and four submarginal white lines. All fringes white between nervules.

N. trigonophora is not likely to be mistaken for any other species except *strigata*, which, however, has a fully developed spot in area 4, almost invariably a white streak in cell on upperside, and has a large broad white band on h.-w. underside at base of costa. Some forms of the *nysiades* group resemble it, but these have transverse white lines in f.-w. cell beneath. Whilst individual examples of the male armature may show differences from that of *kikideli*,

an examination of several preparations convinces me that it would be impossible to decide on the anatomy alone between the two species, if indeed they are really specifically distinct. The case is the more remarkable in that whilst the armatures are so similar they are entirely different from that of any other species examined.

25. Neptis biafra. Pl. XXII, fig. 2 (*prox.*).

Ward, Ent. Mo. Mag., 8, p. 121 (1871); Afr. Lep., p. 12, pl. 9, ff. 1, 2 (1874); Auriv., Rhop. Aeth., p. 168 (1898); Auriv., in Seitz, Macrolep., p. 201 (1913); Holl., Bull. Am. Mus. Nat. Hist., pl. 8, f. 3 (1920) (*prox.*); *Non* Holl., Ent. News, pl. 9, f. 10 (1892).

Cameroon.

Ward's description of this species is as follows:—

Male. Upperside. Both wings brown black; f.-w. the cell crossed by three diagonal white marks, the outer one the largest, the inner one near the base the smallest; beyond the cell three parallel horizontal white streaks, the upper one the smallest; below midway two clear oval white spots; h.-w. crossed midway by a broad band of white, this band is also continued slightly into the f.-w.; fringe of both wings white; following the outer margin of both wings four white bands, the first from the margin very narrow, second rather broader, third broad especially on the h.-w., fourth narrow and rather undulating on the h.-w.

Underside resembles upperside, with the white markings generally broader. Expanse 2·3 in.

Ward's figure, which is rather rough, agrees with the above description. I have never seen an example exactly like the figure, and certainly there is no specimen in the four great British collections. The most characteristic features are the three white marks in f.-w. cell, in which it differs from *paula*, which has one diagonal and one longitudinal mark, and the secondary white band in the h.-w. Unfortunately the type has been lost, M. Oberthür informing me that it was missing when he acquired Ward's collection. The species, if it be a species, has been much confused with other forms, especially owing to the figure published by Dr. Holland (Ent. News, *supra*). This figure represents a form but little removed from typical *nysiades*. This error was sufficiently confusing, but the same author has only

recently (1920, *l. c.*) reasserted that this figure represents Ward's *biafra*. M. Oberthür has kindly sent me a photograph of Ward's figure, and it agrees with the copy we have at Oxford.

The differences between Ward's figure and that of Dr. Holland (Ent. News, 1892) are as follows :—

Ward's Figure.	Holland's Figure.
F.-w. cell with white transverse spot near base followed by a longer transverse mark and a long transverse streak across end of cell.	Three white dots in cell, the outermost rather elongated.
Of the three anterior discal white streaks in f.-w. that nearest costa is very small and faint.	This streak though smaller than the rest is well developed.
Following the discal band of spots is a very distinct though slender white line.	This line obsolescent.
Following the above slender line a well-developed white line formed of spots gradually increasing in size as they approach costa, till that in 6 is quite a large spot 7 × 1·5 mm.	Corresponding line very faint.
H.-w. white discal band about 6 mm. wide.	Ditto about 4 mm.
Following the discal band is a narrow white line arched in 1*a*, 2, 3, and 4 proximally convex.	No such line present.
Distal to above line a band of white spots, their proximal outline well arched (proximally convex). This band is quite 2 mm. wide in 2 and 3.	Only a faint line in this position.

It will thus be seen that whether the insect figured by Holland in 1892 be a form of *biafra* or not, it certainly differs greatly from Ward's own figure of the species.

Dr. Holland, in spite of his emphatic assertions to the

contrary, seems to have had some doubt in the matter, since in Bull. Am. Mus. Nat. Hist. pl. 8, 1920, he publishes another figure of "*biafra*" which agrees neither with his own previous illustration nor with that of Ward. It approaches more nearly to the latter in having the secondary white band on the h.-w., though this is much narrower than in Ward's figure. This 1920 figure rather supports the view that *biafra* is yet another form of the polymorphic *nysiades*, since I have before me examples of the latter which are very close to the figure in question.

Since the above was written, M. Ch. Oberthür has most kindly sent me three specimens which it was hoped might elucidate the mystery. One of these agrees so closely with Ward's original figure that I have illustrated it at fig. 2, Pl. XXII. Practically the only difference between it and Ward's specimen is that in the latter the secondary submarginal white band in h.-w. is rather broader than in M. Oberthür's example. The second of M. Oberthür's examples differs in having a still narrower secondary h.-w. band, indeed it is reduced to a mere line, whilst the third example has the h.-w. white markings so reduced that this secondary band is a mere pale suffusion.

Now it is most unfortunate that this third example, least like Ward's species, is the only male, the other two being females: hence the structure of the armature in an example almost exactly like Ward's figure remains unknown. I have made a preparation of the armature in this one male, and it is of a very simple character, somewhat intermediate between that of a form of *nysiades* and *paula*.

Now whilst the two specimens, one male and one female, which are less like true *biafra*, certainly belong to the same species, the female example which comes so close to Ward's figure is probably specifically different. If the figure on Pl. XXII be carefully examined, it will be noted that in f.-w. just beyond the discal white marks there is a distinct but delicate white line (most easily seen in the left wing). This line is deeply arched in 2, 3, and 4. The corresponding line in the other two specimens is scarcely arched at all; indeed, in one of them it is perfectly straight in area 2. Before we can be sure of the true affinities of these forms much more material is necessary. In the meantime it would appear that Ward's *biafra* is probably a good species, and that forms belonging to the *nysiades* association resemble it very closely.

26. Neptis paula. Pl. XXII, fig. 3; Pl. XXV, fig. 3.

Staud., Iris, 8, p. 368, pl. 8, f. 2 (1896); Auriv., Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201, pl. 48*f* (1913).

S. Leone. Lagos.

Expanse 40–55 mm. Sepia black with white markings. F.-w. with a subclavate mark in cell followed by a transverse mark, beyond which are three longitudinal stripes in 4, 5, and 6, the first long, the last short and very narrow, and all distally divergent. An inner-marginal patch of two spots in 1*a* and 1*b*, and two discal spots, a larger and a smaller in 2 and 3. These discal marks immediately followed by a delicate white line. Beyond this a line of white spots, transverse and linear in 1*b* to 3, crescentic in 4 and 5, and longitudinal and linear towards costa. Beyond this two fine submarginal lines broken by the nervules.

H.-w. with white discal band from inner margin to 6, about 4 mm. wide followed by a faint pale line. Beyond this a secondary discal band of white subquadrate spots followed by two very fine submarginal lines.

Underside as above, but all white markings more extensive. F.-w. with white at base of costa extending to a point below origin of 2 in f.-w. Traces of an additional fine marginal line in both wings.

N. paula is not rare in collections. The male armature is of so simple a character as to offer little suggestion in regard to affinity. The species has been bred from a pupa found by Lamborn near Lagos. The pupal skin is in the Hope Collection. The hind and inner margins of the wing-cases project so as to form prominent lateral ridges, and on the head there are two bifurcated horn-like projections.

27. Neptis rothschildi. Pl. XXII, fig. 4; Pl. XXV, fig. 4.

Eltr., Ent. Mo. Mag., Ser. 3, vol. vii, p. 28 (1921).

Congo Region (Kassai, Kingour Forest).

" Expanse 50–55 mm. Sepia black with white markings. Forewing with a white cell streak, beginning at base and passing between nervures 4 and 5 to a point considerably beyond the origin of 3. Elongated inner-marginal spots in 1*a* and 1*b*, distinctly separated. Two similar discal spots in 2 and 3 still more separated.

A white dot distally placed in area 4, and a series of three well-separated elongated spots or streaks in 5, 6, and 9. Distal to these discal spots and following their contour a very fine line of greyish-white scales. Beyond this a well-developed white line, broken into spots by the nervules. Finally two delicate submarginal lines.

"Hind-wing with a discal band about 3–4 mm. wide from inner margin to nervule 6, the spots of which are distinctly separated by the nervules. Distal to this a very faint line, rather paler than the ground-colour, followed by a narrow white secondary band of quadrate spots separated by the nervules. Two delicate submarginal lines.

"Underside. Pattern of upperside repeated, but the white marks more pronounced on a paler ground. Fore-wing white on costa at base. Cell streak larger and more sharply outlined. Above end of cell two or three additional white streaks. White submarginal bands much more distinct, especially inner one, which is widened to about 1·5 mm., and there is an extra distal line at apex.

"Hind-wing with a white costal band from base to middle of costa. The secondary discal band composed of spots much larger than above."

This species most nearly resembles *paula* Staud., but is quite differently marked in fore-wing cell above and below. Ward's *biafra* is also similar, but has three transverse white stripes in cell. All three differ from other described species in having a secondary white discal band on the hind-wing. The male clasper of the present species is quite different from that of *paula*.

28. Neptis sextilla.

Mab., Le Natural., 2, p. 99 (1882); Hist. Mad. Lep., 1, p. 174 (1887); Auriv., Rhop. Aeth., p. 167 (1898); in Seitz, Macrolep., p. 201 (1913).

Madagascar.

I am unable to give any information with regard to this species beyond Mabille's description. The latter refers to a figure on a plate which appears never to have been published. The author describes it as allied both to *saclava* and *kikideli*. It would seem unnecessary to reprint here the original description, which though lengthy unfortunately gives little idea of the appearance of the insect. Aurivillius in Seitz (*l. c.*) places it next after *paula*, though merely on probability. The type is apparently unknown, and so far no other example has been noted.

29. Neptis nicoteles. Pl. XXII, fig. 5; Pl. XXV, fig. 9.

Hew., Ent. Mo. Mag., 10, p. 206 (1874); Holl., Ent. News, 3, pl. 9, f. 8 (1892); Auriv., Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 202, pl. 48*e* (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 163 (1920).

S. Leone to Angola. Cameroon to Mombasa.

Expanse 37–42 mm. Ground-colour sepia black with white markings. F.-w. with a white clavate mark nearly filling cell. An inner-marginal patch in 1*a* and 1*b* followed by a more or less rounded patch of two spots in 2 and 3. A subapical patch of white in 4, 5, 6, and 9. In 4 this patch begins only just below nervule 5, so that the spot in that area is a mere streak. The discal marks followed by a pale line, beyond which are three delicate whitish submarginal lines. Fringes white between nervules.

H.-w. with a discal white band from inner margin to area 6 about 5 mm. wide, almost straight on both edges, nervules thereon not or very little blackened. Discal and marginal lines as on f.-w.

Underside. F.-w. just noticeably white at base of costa. H.-w. with a white streak at base of costa followed by two more on the dark ground of basal area. Other marks as above, but white submarginal lines much more accentuated.

This little species is apparently not very common. It may be distinguished from others by the streak of white below and adjacent to nervule 5 in f.-w.

30. Neptis mixophyes. Pl. XXII, fig. 7.

Holl., Ent. News, 3, p. 249, pl. 9, f. 11 (1892); Auriv., Rhop. Aeth., p. 169 (1898); in Seitz, Macrolep., p. 202 (1913).

? = *nicodice*. Grünb., Sitzb. Ges. Naturf. Fr. Berl., p. 470 (1910).

Bipindi. Ogowe.

Expanse 32–42 mm. Sepia black with white markings. F.-w. with white mark in cell, the edges of which are straight and the end pointed. An inner-marginal patch of two spots in 1*a* and 1*b*, followed by two subquadrate marks in 2 and 3, slightly separated. In 4 a small distally placed triangular spot, two separated elongated spots in 5 and 6, and a small mark in 9. Beyond these discal marks a fine white line broken at nervules and bent deeply inwards in 1*b*. Two whitish submarginal lines interrupted only by the nervules, and indications of a third on the margin. All fringes white between nervules.

H.-w. with a white discal band about 5 mm. wide, straight proximally, and outwardly rather indented at nervules. This followed by a pale discal line, and two or three submarginal lines.

Underside. F.-w. as above but white marks more accentuated. No white at base of costa. H.-w. with slender white line on costa at base, followed by two more, the first broad, the second narrow and faint. Beyond the discal band the pale line forms a distinct row of whitish spots, and the first marginal line is widened into conspicuous white spots, the others broader and more distinct than above.

I can find nothing in Grünberg's description of his *nicodice* to distinguish it from *mixophyes*, and there is but little except the continuity of the f.-w. submarginal lines to distinguish either from *nicobule*. However, as this is the principal distinction between *agatha* and *seeldrayersi*, it may be that *nicobule* is a separate species. Lack of material, all three forms being rare, has prevented me from making comparative preparations of the male armature, the only example available and apparently belonging to this species, is a female. The figure on Pl. XXII is really a photograph of Holland's figure. I included this rather than the actual specimen in my possession, since the latter does not agree absolutely with Holland's figure, having an additional spot in f.-w. on costa.

31. Neptis nicobule. Pl. XXII, fig. 6; Pl. XXV, fig. 10.

Holl., Ent. News, 3, p. 249, pl. 9, f. 7 (1892); Auriv., Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 202 (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 164 (1920).

S. Leone to Angola.

A full description of this species would be almost a repetition of that of *mixophyes*, and it will suffice to call attention to the slight differences. In Holland's original figure the f.-w. cell mark is clavate and well rounded distally instead of straight sided and pointed. The discal spots are small and rounded instead of elongated, and the submarginal lines are notably interrupted in 3. From an examination of the rather scanty material at my disposal I am inclined to think that the f.-w. submarginal lines furnish almost the only difference, and without much longer series I am unable to say whether even this is constant.

32. Neptis nicomedes. Pl. XXII, fig. 8; Pl. XXV, fig. 11.

Hew., Ent. Mo. Mag., 10, p. 205 (1874); Kirby, Handb. Lep., 1, p. 147, pl. 20, f. 3 (1894); Auriv., Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201 (1913).

Ashanti to Angola. Uganda.

f. *quintilla*. Pl. XXII, fig. 9.

Mab., Ann. Ent. Fr., (6), 10, p. 21, pl. 2, f. 7 (1890); Auriv., Ent. Tidskr., 15, p. 284 (1894) (as *nicomedes*); Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201 (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 162 (1920).

Lagos. Ivory Coast. Cameroon. Angola. Kassai. Entebbe.

f. *puelloides*, f. nov. Pl. XXII, fig. 10.

Lagos. Gold Coast. Kampala.

nicomedes nicomedes.

Expanse about 38 mm. Sepia black with white markings. F.-w. with a white mark in cell sometimes clavate extending from near base, widening and curving over downwards and outwards to end of cell, sometimes divided into two, the basal part remaining only as a dot. On inner margin a white mark in 1*a* and 1*b*, the marginal part rather wide and the inner edge forming a continuous straight line with that of h.-w. discal band. A large continuous white discal band from 2 to 9, its outer and inner edges regularly curved, proximally concave, distally convex. Beyond this a pale line, faint or well developed, followed by a narrow white line which is usually expanded into a spot near apex. Two delicate submarginal lines, more or less interrupted in area 3, especially beneath.

H.-w. with a broad discal band about 5 mm. wide, both edges rather straight, and nearly parallel, extending from inner margin to 6, this followed by a pale line and three submarginal lines.

Underside. The clavate mark in f.-w. cell better developed than above, and sometimes with a faint pale transverse line beyond it. Base at costa faintly white. Other marks as above but marginal pattern whiter, and interruption of lines more obvious in 3, and often in 6.

H.-w. with a conspicuous curved white band at base of costa, extending to middle of same, followed by two narrow lines, the lower rather longer than the upper. Other markings as above but marginal lines more developed.

nicomedes quintilla.

Resembles type form, but the spots in f.-w. 2 and 3 are short and quadrate, so that the contour of the inner edge of the discal patch is materially altered. All stages of intermediates occur.

nicomedes puelloides.

F.-w. cell without any trace of white mark, and on underside the white in cell is reduced to a line on subcostal which curves sharply downwards and outwards at cell end. Just beyond this a transverse white line. The spots in f.-w. 2 and 3 vary in length, so that the proximal edge of discal patch may be of the type form or may approach that of *quintilla*. This form bears a close resemblance to *puella*, but may generally be distinguished therefrom by the proximal edge of the f.-w. discal band, which in *nicomedes* is concave or even indented, whilst in *puella* it is straight or even convex. Also in *puella* there is no interruption in the f.-w. submarginal lines. The interruption of the f.-w. lines is the sole distinction apart from the armature between *nicomedes* f. *puelloides* and certain forms which appear to be conspecific with *nysiades* f. *continuata*.

Type Hope Collection, Oxford. Taken by Lamborn at Oni, Lagos, Dec. 1911.

33. Neptis puella. Pl. XXII, fig. 11; Pl. XXV, fig. 12.

Auriv., Ent. Tidskr., 15, p. 285, f. 11 (1894); Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201 (1913).

Cameroon. Congo. Uganda.

Expanse about 35 mm. Sepia black with white markings. F.-w. without marks in cell. An inner-marginal patch in 1*a* and 1*b*, its inner edge quite or nearly continuous with that of h.-w. discal band. A large continuous discal patch from 2 to 9, the inner edge of which is either straight or convex. This patch not or but little reduced in width till just before reaching costa, where the spot in 9 is very small. The usual discal pale line followed by three fine whitish or bluish-grey submarginal lines, these interrupted only at nervules. Fringes white between nervules.

H.-w. with large discal patch, continuous and with smooth outline followed by discal and submarginal lines as on f.-w.

Underside. F.-w. as above but white markings especially submarginal lines much accentuated. Costa whitish at base. In cell a longitudinal streak on subcostal, followed by a diagonal line across end of cell.

H.-w. with large white curved band on costa from base to a point just above end of proximal edge of discal band, followed by two narrow whitish lines. Otherwise as above with pale lines accentuated, the discal line brownish white.

This species may be distinguished by its small size and by the large continuous discal patch in f.-w. The straight or convex proximal edge of this patch and the uninterrupted submarginal lines distinguish it from *nicomedes puelloides*.

34. Neptis nina. Pl. XXV, fig. 13.

Staud., Iris, 8, p. 369, pl. 8, f. 1 (1896); Auriv., Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201 (1913).

E. Africa (Usagara).

Expanse about 30–35 mm. Resembles *puella*, but the f.-w. discal patch is smaller and rapidly narrows from area 4 almost to a point in 6. The discal pale line very faint, but the first submarginal line well developed and expanded into spots towards apex. The submarginal lines interrupted in 3 especially beneath. First submarginal line on h.-w. also formed of distinct white streaks.

I have seen but two examples of this species. Aurivillius regards it as a race of *puella*, but if the structure of the armature is constant then it must be given specific rank. It is easily recognised and not at all like any other form except *puella*, from which it differs as above described.

35. Neptis melicerta. Pl. XXIII, fig. 1; Pl. XXV, fig. 14.

Drury, Ill. Exot. Ins., 2, p. 34, pl. 19, ff. 3, 4 (1773); Herbst, Naturs. Schmett., 9, p. 84, pl. 238, ff. 5, 6 (1798); Staud., Exot. Schmett., 1. p. 147 (1886); Holl., Ent. News, 3, pl. 9, f. 5 (1892); Karsch, Berl. Ent. Zeit., 38, p. 186 (1893); Auriv., Rhop. Aeth., p. 169 (1898); Roth. & Jord., Novit. Zool., p. 537 (1903); Rogers, Trans. Ent. Soc. Lond., p. 505 (1908); Neave, Proc. Zool. Soc., p. 33 (1910); Auriv., in Seitz, Macrolep., p. 202, pl. 48*e* (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 164 (1920).

= *blandina*. Cramer, Pap. Exot., 4, p. 76, pl. 327, ff. E, F (1872).

= *melinoe*, God., Enc. Meth., 9, p. 432 (1823).

S. Leone to Uganda.

subsp. *goochi*. Pl. XXIII, fig. 2.

Trimen. Trans. Ent. Soc. Lond., p. 336 (1879); S. Afr.

Butt., 1, p. 273, pl. 5, f. 6 (1887); Butl., Proc. Zool. Soc., p. 65 (1888); Auriv., Rhop. Aeth., p. 169 (1898); Neave, Proc. Zool. Soc., p. 34 (1910); Auriv., in Seitz, Macrolep., p. 202, pl. 48*f* (*not typical*) (1913).

E. Africa to Natal.

melicerta melicerta.

Expanse 30–55 mm. Sepia black with white markings. F.-w. with a large white mark in cell, wedge shaped, sometimes suffused on subcostal side, cut off rather sharply at distal end, and followed closely by a white triangular mark; this sometimes faint, and rarely joined to cell mark at posterior corner. On inner margin a white streak-like mark in 1*a* with a second smaller one in 1*b*, these generally confluent. In 2 and 3 two elongated white marks, usually separated by broadly blackened nervule. In 4 a small spot distally placed, and in 5, 6, and 9 three elongated spots, the first two generally well separated. Following these discal marks a pale line of variable distinctness beyond which are three delicate marginal lines, they and the white marks on fringes being more or less interrupted in area 3 and often in 6.

H.-w. with a white discal band, proximal edge of which is very straight, and continuous with that of the f.-w. inner-marginal spots. Distal edge moderately straight, but often indented at the nervules. A pale discal line followed by internervular marks rather darker than ground-colour, then another pale line (the first of the marginal series), and finally two delicate but usually well-defined marginal lines.

Underside. F.-w. just perceptibly white at base of costa, other markings as above on a rather paler ground, but pale lines much accentuated. An additional marginal line which with the others is notably interrupted in 3.

H.-w. with a short white curved band at base, followed by two straighter lines on the dark ground. Other markings as above but pale lines more distinct, and an additional one on margin.

melicerta goochi.

This form differs from the type in having the f.-w. discal spots more confluent, and in particular in the obsolescent character of the cell mark. The typical *goochi* is really an intermediate between two more definite forms, the one having all white marks fully developed (= Auriv. fig. *l. c. supra*) and the discal spots confluent, the other having the f.-w. cell mark reduced to a spot at the distal end, and the discal spots only rather more confluent than in the typical form. All kinds of intermediates occur, though the prevalence of the diminished cell-spot form in S. and E. perhaps entitles it to subspecific rank.

Neptis melicerta is very common and easily recognised. The male armature is of a simple structure not particularly constant and but little distinctive. The species has been bred by both Lamborn and Farquharson. Only the pupal skins are preserved. They show, though to a less extent than in that of *paula*, the expansion of the wing-cases, and appear to have only a single horn-like projection on the head.

36. Neptis strigata. Pl. XXIII, fig. 3; Pl. XXV, fig. 15.

Auriv., Ent. Tidskr., 15, p. 284, f. 10 (1894); Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201, pl. 48*e* (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 163 (1920).

Cameroon to Uganda and S. Sudan.

Expanse 45–50 mm. Rich sepia black with white markings. F.-w. with a white mark in cell, rather variable, but on the whole clavate. When well developed, of curved pyriform outline. A large inner-marginal patch of two spots in 1*a* and 1*b*, the inner edge of which is not usually continuous with that of the h.-w. discal band. Two rather short outwardly rounded spots in 2 and 3, tending to be separated distally, and a subapical patch of four spots in 4, 5, 6 and 9, confluent or but little separated. These followed by a pale line and three submarginal lines, the first of which is developed into a diagonal streak or streaks near the apex. Marginal lines interrupted only by the nervules. Fringes white in internervular spaces.

H.-w. with a white discal band about 6 mm. wide from inner margin to 6, where it is rounded off. Following this a line rather paler than the ground-colour, and three delicate submarginal lines.

Underside. Ground-colour paler, white marks more developed. F.-w. faintly white at base of costa. Clavate mark in cell followed by a pale or white longitiudinal mark, sometimes with traces of diagonal streaks above it near costa. The first submarginal line on both wings developed into a band of spots. Traces of an additional line at apex.

H.-w. with conspicuous basal white band from base of costa to about the middle of its length, followed by two narrow white bands, the second much larger than the first.

N. strigata is easily distinguished on outward characteristics, but its specific distinction is very doubtful, the male armature being quite indistinguishable from that of a peculiar form of *nysiades* which I have dissected. This *nysiades* form nearly resembles Holland's *continuata*.

I have now described at length all the species or forms of *Neptis* which can with moderate certainty be distinguished. There remains a residuum of forms which seem to merge one into another in such a way as to render it impossible to separate them specifically even by the male armature. If we examine a series of preparations of the genitalia taken from these forms, and then arrange our preparations in the order of their resemblance, we shall find a great difference in structure between the first and the last of the series, but no satisfactory distinction between any two or three consecutive examples. Moreover, if we then arrange the specimens themselves we shall find that their patterns do not by any means follow the resemblance of the armatures. Thus, as already stated, the armature of *strigata* is indistinguishable from that of a form very near Holland's *continuata*. Some examples of Neave's *conspicua* have armatures which resemble those of typical *nysiades* sufficiently to warrant us in agreeing with Aurivillius, who regards them as conspecific. But one of Neave's co-types of *conspicua* has an armature of a slightly different pattern, whilst the type of *conspicua* itself has the two claspers of the same individual very different in structure. It is impossible to deal on ordinary taxonomic lines with an assemblage of this kind. It is useless to decide that a given example is the same as Holland's *continuata* because it resembles the published figure of that form. We do not know the structure of the armature in the type. A specimen outwardly indistinguishable from *conspicua* may, as I have shown, possess claspers of a different structure, or, since the armature of the type specimen is asymmetrical, we might have two examples outwardly resembling *conspicua* one of which had claspers like the right one of the type, the other with claspers like the left.

In our classifications we attempt to work in what may be metaphorically termed watertight compartments. Nature, though frequently conniving at our methods, refuses always to be bound by them, and we must, I think, decide more freely to admit the existence of indeterminate forms. We have an outstanding example of this in the many indefinite forms which are comprised under the specific name *Acraea acrita*, as set forth in my monograph of the genus *Acraea* (Trans. Ent. Soc., 1912). I propose therefore to give a description of a typical example of *Neptis nysiades*, to detail also the other named patterns which

appear to be associated with it, and finally to give the characteristics of several specimens which, as above explained, I consider must for the present at least be regarded as indeterminate forms of the same species. Such forms come within our definition of a species if we assume that they constitute what Prof. Poulton has termed a syngamic chain (Proc. Ent. Soc., p. cxvi, 1903), in which consecutive links are apparently capable of pairing, although the terminal elements may be too far specialised to admit of intercourse, and this not necessarily in relation to any special geographical distribution. Indeed, in cases of this kind syngamic "complex" would be more expressive than "chain."

37. Neptis nysiades. Pl. XXIII, fig. 4 (nearly typical); Pl. XXV, figs. 16, 17.

Hew., Exot. Butt., (*Neptis*) pl. 1, ff. 3, 4 (1868); Trimen, S. Af. Butt., 1, p. 271 (1887); Auriv., Ent. Tidskr., 15, p. 285 (1894); Holl., Ent. News, 3, pl. 9, f. 10 (1892) (*prox.*) (as *biafra*); Auriv., Rhop. Aeth., p. 167 (1898); in Seitz, Macrolep., p. 200, pl. 48*e* (*prox.*) (1913).

Lagos to Uganda.

f. *metanira*. Pl. XXV, fig. 20.

Holl., Ent. News, 3, p. 249, pl. 9, f. 6 (1892); Auriv., Rhop. Aeth., p. 167 (1898); in Seitz, Macrolep., p. 201 (1913).

Congo Region to Uganda.

f. *continuata*. Pl. XXIII, fig. 8.

Holl., Ent. News, 3, p. 249, pl. 9, f. 9 (1892) (as *biafra continuata*); Auriv., Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201 (1913).

Congo to Uganda.

f. *clarei*. Pl. XXIII, fig. 6.

Neave, Novit. Zool., 11, p. 330. pl. 1, f. 15 (1904); Auriv., in Seitz, Macrolep., p. 201 (1913).

Nyangori.

f. *conspicua*. Pl. XXIII, fig. 7; Pl. XXV, figs. 18, 19.

Neave, Novit. Zool., 11, p. 329. pl. 1, f. 15 (1904); Proc.

Zool. Soc., p. 34 (1910); Auriv., in Seitz, Macrolep., p. 201 (1913).

Togo to Uganda.

nysiades nysiades.

Examples precisely agreeing with Hewitson's type are rare. In it there is a small streak and a dot in f.-w. cell, an inner-marginal patch of which the proximal edge is continuous with that of the h.-w. discal band. Two short separated subquadrate spots in 2 and 3, and a subapical series of four in 4, 5, 6, and 9, slightly separated by the nervules, followed by the usual pale discal and submarginal lines, the latter not interrupted in area 3.

Beneath the f.-w. has a basal streak followed by two diagonal streaks, and the h.-w. has a white costal mark at base, followed by two less distinct whitish lines. All pale discal and submarginal lines more distinct than above. Expanse about 40–50 mm.

From this typical form we pass to a modification of much more frequent occurrence (Pl. XXIII, fig. 5) very closely resembling the figure in Seitz quoted above, pl. 48*e*. This form may be recognised by the much larger discal spots in f.-w., especially the subapical series which are very long (about 8 mm. in area 4) and distally divergent. The pale lines often well marked and white, the first of the submarginal series developed into spots towards apex. The f.-w. cell marks are characteristic, consisting of a spot near base, followed by a short and then a longer diagonal stripe. On the underside the first two marks are joined to form a subcostal line having a small projection about the middle of its length and bent sharply downwards and outwards at its end. This followed by a well-marked diagonal stripe at cell end. This form is very like *strigata* except for the different arrangement of cell marks. (Though for the present I have kept *strigata* separate it is probably only another form of *nysiades*.)

The form *clarei* differs in having the subapical series of f.-w. spots ending in a faint streak just beyond nervule 6 on upperside, thus leaving a rather conspicuous area of ground-colour between the subapical series and the costa. The subapical spots are but little separated, and the inner marginal patch is basally prolonged, so that its proximal edge is not continuous with that of the h.-w. discal band. There are no white marks in f.-w. cell above.

From this we pass through intermediate forms in which the f.-w. spots become less and less separated to the type

of f. *conspicua*, in which the discal spots are all joined and form a continuous patch from area 2 to 9. In the type the spots in 2 and 3 are proximally shorter than in 4, so that the inner edge of the patch is sharply angulated on nervule 4. (Very small examples of the *conspicua* form are extremely like *nicomedes psolloides*, but can be distinguished by the continuity of the f.-w. lines in area 3.)

It is in *conspicua* that we begin to get great instability in the form of the male armature. That of the type is asymmetrical, whilst in examples outwardly agreeing more or less closely with the type we find various degrees of shortening and broadening of the claspers with irregular modification of the small projection at the end of that organ. From forms of this pattern we pass to examples in which there is a shortening of the spots in 4, 5, and 6 so that the discal band presents a more evenly curved proximal outline. At the same time the spots become more or less separated by increased blackening of the nervules, the h.-w. discal band is also somewhat narrowed, and we have the form *continuata* of Holland. A slight further reduction of the white markings, especially the spot in f.-w. 2, produces Holland's *melanira*, which seems hardly worth a separate name.

I have before me several examples from the neighbourhood of the Kassai River, the property of my friend Mr. J. J. Joicey. These have an expanse of about 50 mm. Many of them are indistinguishable from forms of *seeldrayersi* except for the absence of white dots in f.-w. cell above, and the streaked instead of spotted pattern in that area beneath. I have figured one on Pl. XXIII, fig. 9.

Other examples from the same neighbourhood are smaller (35–40 mm.), and have all the f.-w. discal spots in 2 and 3 fairly long, rounded at both ends, and about equally separated from each other and from that in 4.

Lastly there is a form from Cameroon, Congo, Uganda, etc., which resembles *conspicua* except that there is a notable interval of the ground-colour between the spot in 3 and that in 4. Pl. XXIII, fig. 10.

I refrain from naming these forms since they are not peculiar to definite localities, whilst numerous intermediates occur in long series. The male armatures are as variable as the patterns, and the whole assembly must for the present be regarded as an unstable species possibly modified by intrageneric mimicry of the kind so elaborately

illustrated by the multiple forms of *Heliconius melpomene*. For those who wish to arrange their collections as correctly as possible, I can only suggest that any form which does not present the distinctive characteristics of one of the better-defined species and of which the male armature is variable and not well characterised should be referred to *nysiades*, until longer series from many localities may perhaps enable us to revise these forms in a more systematic manner.

38. Neptis lugubris.

Rebel, Ann. des K. K. Naturhist. Hofmus. Wien., p. 241, pl. 18, f. 4 (1914).

Since the above paper went to press I have discovered the description of this species. It is accompanied by a very poor photograph, from which it is impossible to derive much information as to affinity. It resembles a small example of *agatha* with much reduced white discal bands, and is described as having no white dot in f.-w. cell above or beneath. The state of the f.-w. submarginal lines is not described, but from the photograph they would appear to be continuous. The locality is given as Lake Tanganyika. Only one example was received.

Explanation of Plate XX.

Fig. 1. *Neptis frobenia* Fab. ♂, Mauritius, Coll. Hew. (London).
2. ,, *dumetorum* Boisd. ♀, Reunion (Oxford).
3. ,, *mayottensis* Oberth. ♂, Mayotte I. (Oxford).
4. ,, *comorarum* Oberth. ♀, Grand Comoro (Oxford).
5. ,, *saclava marpessa* Hopff. ♀, Taveta (Oxford).
6. ,, *metella* Doubl. ♀, Lagos (Oxford).
7. ,, *nemetes nemetes* Hew. ♂, Lagos (Oxford).
8. ,, *poultoni* Eltr. ♂ (Type), Chagwe, Uganda (London).
9. ,, *incongrua incongrua* Butl. ♀, Dabida Hills (Oxford).
10. ,, *woodwardi* Sharpe ♀, Kenia (Oxford).
11. ,, *ochracea ochracea* Neave ♀, Chagwe, Uganda (Oxford).
12. ,, *exaleuca exaleuca* Karsch ♂, Bitje, Cameroon (London).

Explanation of Plate XXI.

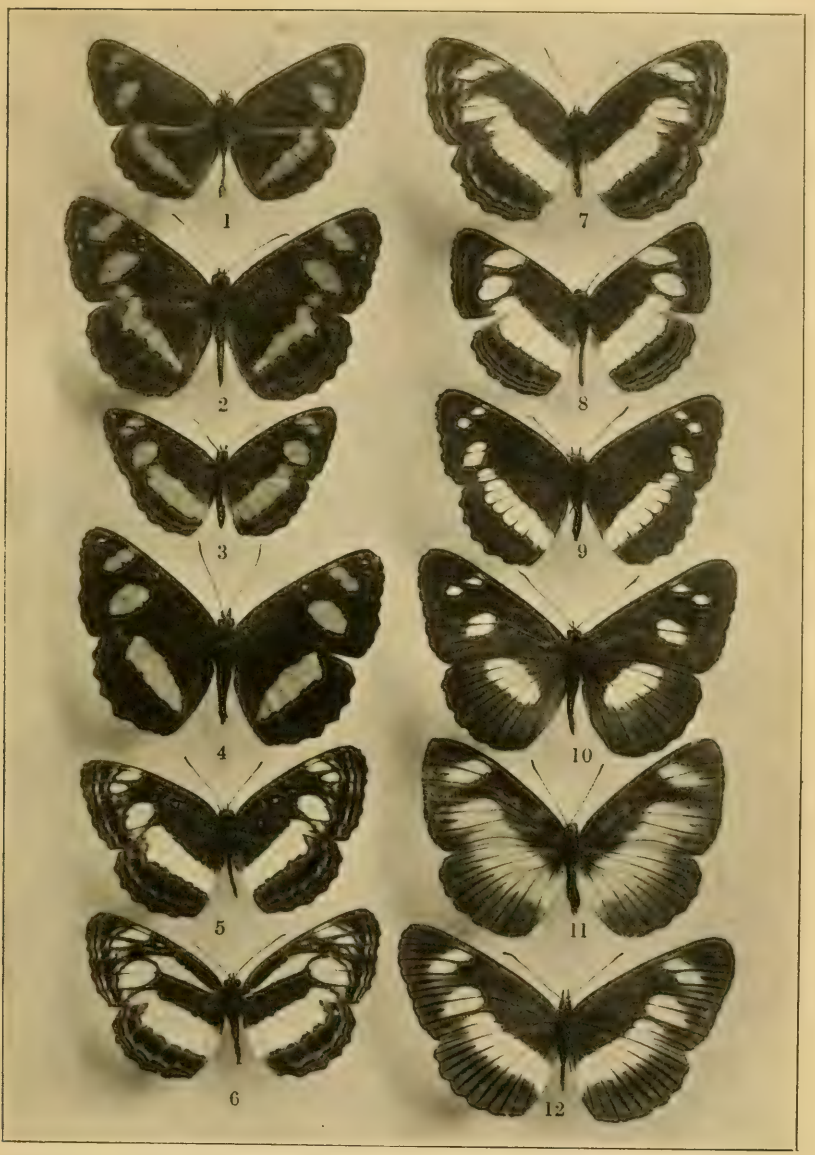
Fig. 1. *Neptis swynnertoni* Trim. ♀, Melsetter (Oxford).
2. .. *agatha* Stoll ♀, Machakos (Oxford).
3. .. *jordani* Neave ♀, L. Bangucolo (Oxford).
4. .. *nebrodes* Hew. ♀, Lagos (Oxford).
5. .. *jamesoni* Godm. ♀, Lagos (Oxford).
6. .. *lermanni* Auriv. ♀, Kassai River (Oxford).
7. .. *seeldrayersi* Auriv. ♀, L. Tanganyika (Oxford).
8. ,, *barnsi* Eltr. ♂ (Type), Belg. Congo (Coll. Joicey).
9. ,, *rogersi* Eltr. ♀ (Type), Mombasa (Oxford).
10. .. *kikideli* Boisd. ♀, Ambinanindrano (Oxford).

Explanation of Plate XXII.

Fig. 1. *Neptis trigonophora* Butl. ♂, Mombasa (Oxford).
2. .. *biafra* Ward ♀, Cameroon (Coll. Oberthür). This example agrees very nearly with Ward's original figure.
3. ,, *paula* Staud. ♀, Lagos (Oxford).
4. .. *rothschildi* Eltr. ♂ (Type), Manyema (Tring).
5. ,, *nicoteles* Hew. ♂, Semliki Valley (Oxford).
6. ,, *nicobule* Holl. ♂, Lagos (Oxford).
7. .. *mixophyes* Holl. (copied from Holland's figure).
8. .. *nicomedes nicomedes* Hew. ♂, Entebbe (Oxford).
9. ,, ,, *quintilla* Mab. ♀, Entebbe (Oxford).
10. ,, ,, *puelloides* Eltr. ♂ (Type), Lagos (Oxford).
11. ,, *puella* Auriv. ♀, Entebbe (Oxford).

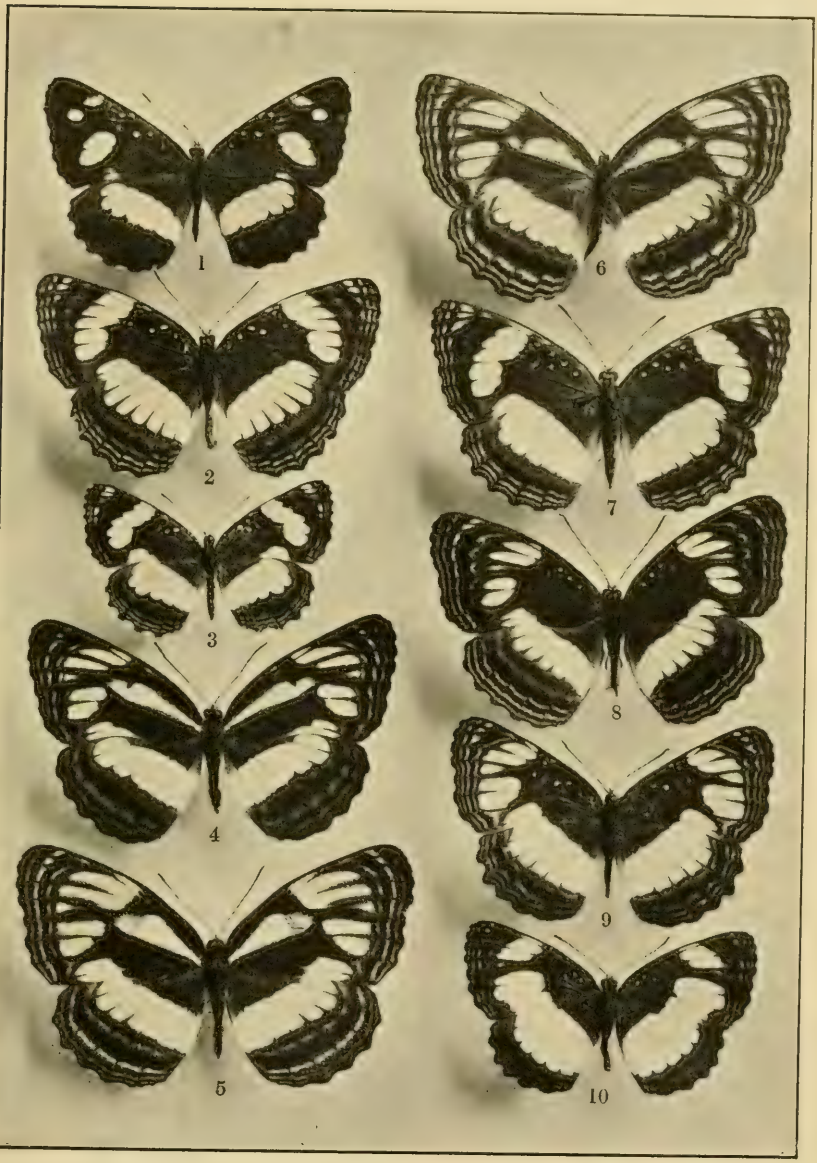
Explanation of Plate XXIII.

Fig. 1. *Neptis melicerta melicerta* Dru. ♂, Unyoro (Oxford).
2. ,, ,, *goochi* Trim. ♂, Durban (Oxford).
3. ,, *strigata* Auriv. ♂, Entebbe (Oxford).
4. .. *nysiades* Hew. ♂, Bitje (Coll. Joicey). An example very near Hewitson's original figure.
5. ,, ,, ♀, Lagos (Oxford). A form much commoner than the type.
6. ,, ,, f. *clarei* Neave ♂, Entebbe (Oxford).
7. .. .. f. *conspicua* Neave ♂, Addah, W. Africa (Coll. Joicey).
8. .. ,, f. *continuata* Holl. ♂, Cameroon (Coll. Joicey).
9. ,, ,, f. (see p. 586) ♂, Kassai R. (Tring).
10. ,, ,, f. (see p. 586) ♂, Chagwe (Oxford).



A. Robinson, Photo. *Vaus & Crampton, Ltd.*

FORMS OF NEPTIS.



A. Robinson, Photo. *Vaus & Crampton, Ltd.*

FORMS OF NEPTIS.

A. Robinson, Photo. *Vaus & Crampton, Ltd.*

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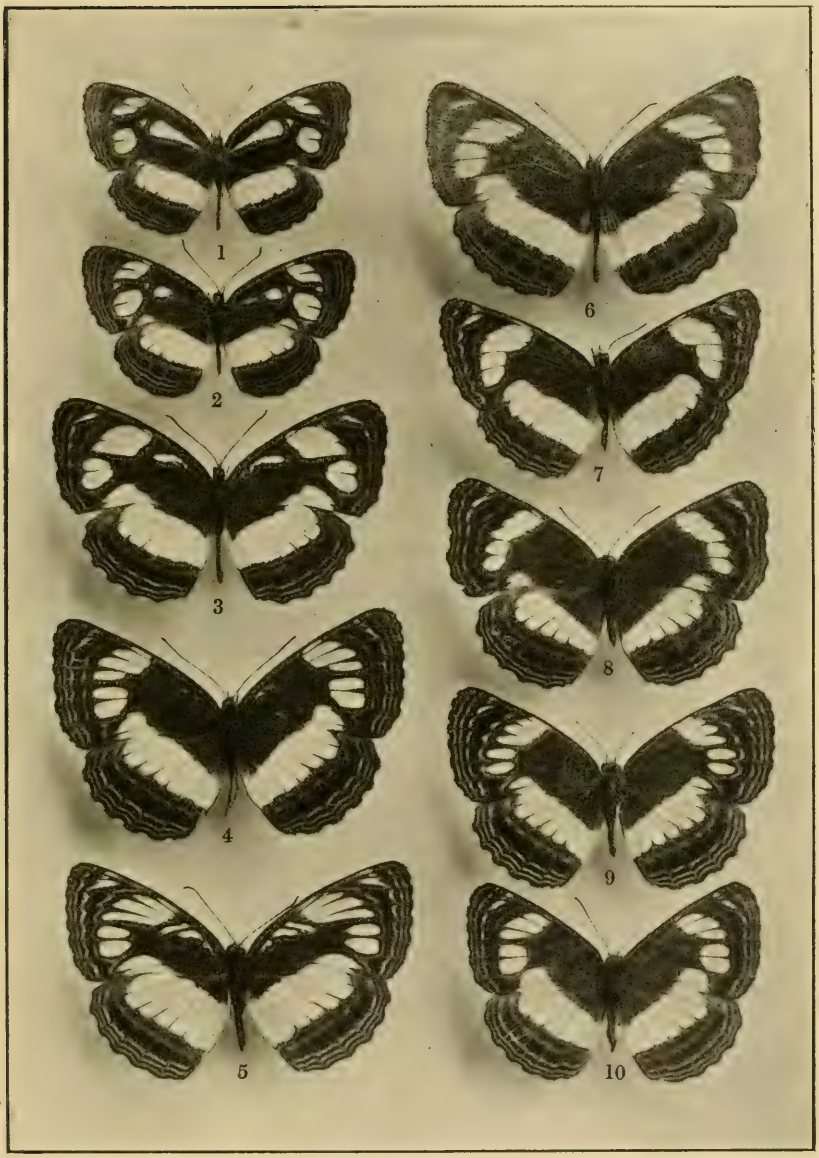
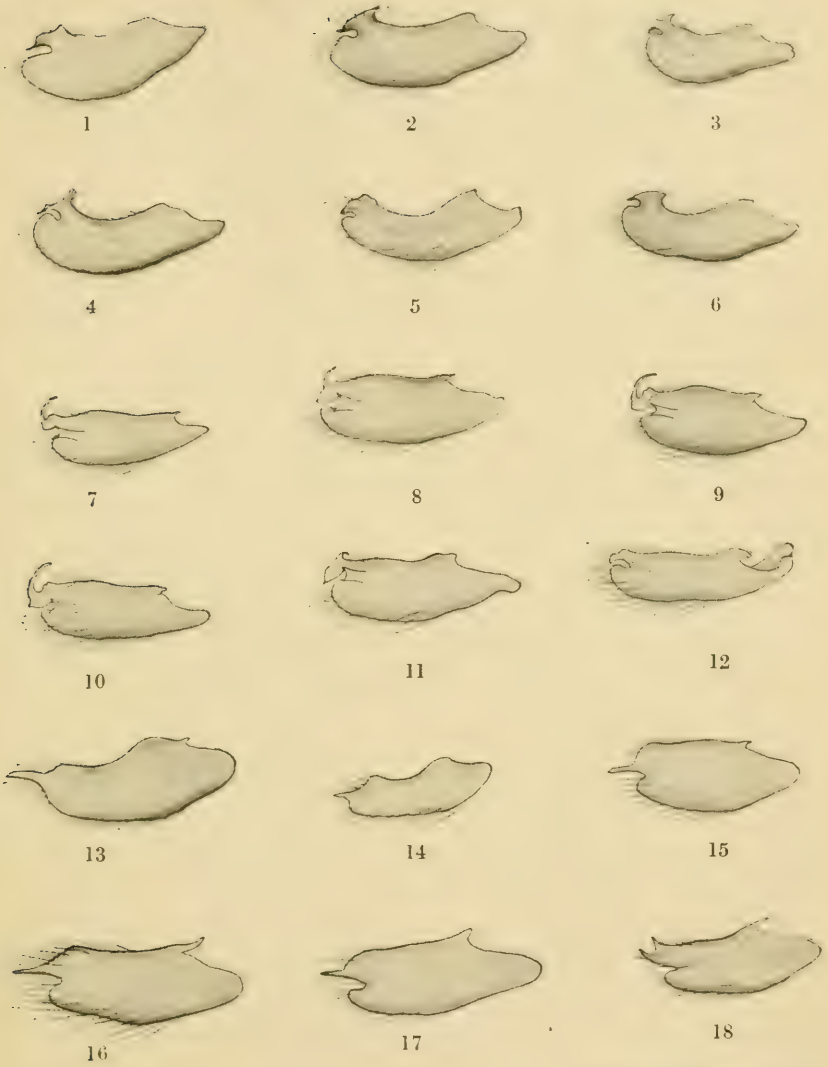


A. Robinson, Photo. *Vaus & Crampton, Ltd.*

FORMS OF NEPTIS.



H. Eltringham, del.

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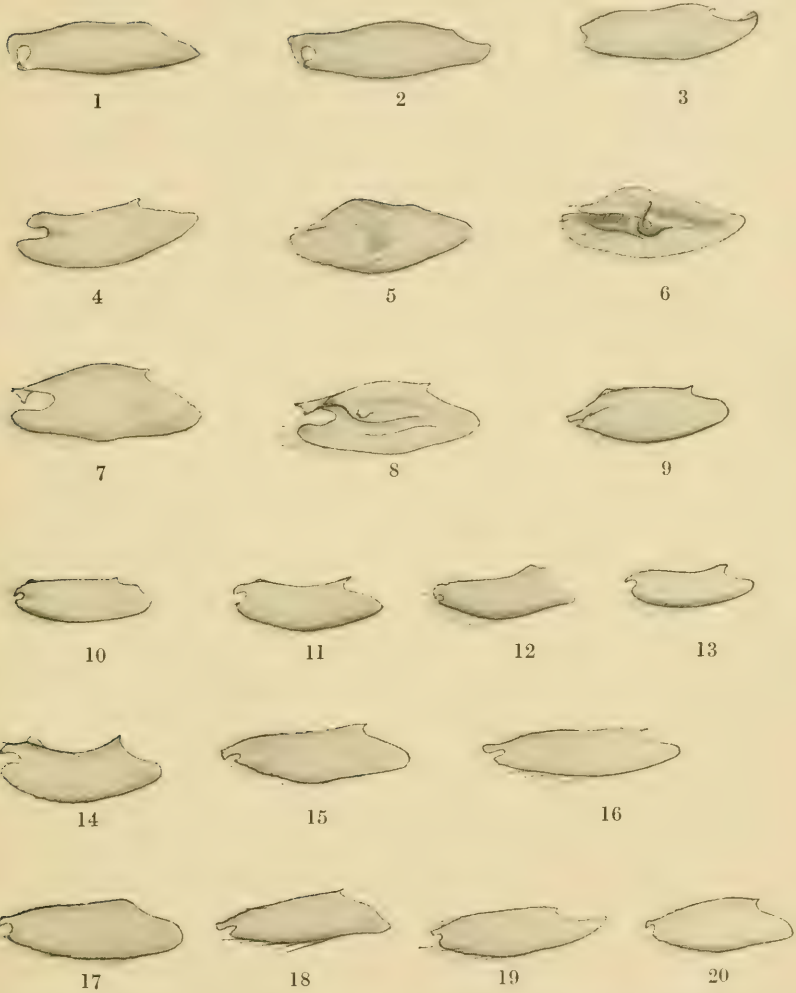
GENITAL ARMATURES OF NEPTIS.



H. Eltringham, del. *Vaus & Crampton, Ltd.*

GENITAL ARMATURES OF NEPTIS.

Explanation of Plate XXIV.

Male Claspers of Forms of *Neptis*.

Fig. 1. *frobenia*.
2. *dumetorum*.
3. *mayottensis*.
4. *comorarum*.
5. *saclava*.
6. *metella*.
7. *nemetes* (f. *carpenteri*).
8. *incongrua*.
9. *woodwardi*.
10. *ochracea*.
11. *exaleuca*.
12. *swynnertoni*.
13. *agatha*.
14. *jordani*.
15. *nebrodes*.
16. *jamesoni*.
17. *lermanni*.
18. *barnsi*.

Explanation of Plate XXV.

Male Clasfers of Forms of *Neptis*.

Fig. 1. *kikideli*.
2. *trigonophora*.
3. *paula*.
4. *rothschildi*.
5. *seeldrayersi* (external).
6. ,, (internal).
7. *poultoni* (external).
8. ,, (internal).
9. *nicoteles*.
10. *nicobule*.
11. *nicomedes*.
12. *puella*.
13. *nina*.
14. *melicerta*.
15. *strigata*.
16. *nysiades* (nearly typical).
17. ,, (another example of the same).
18. ,, f. *conspicua* (left clasper of the type).
19. ,, ,, (a co-type).
20. ,, f. near *metanira*.

XIV. *On the number of joints in the antennae of* Haliplidae *and* Paussidae (*Coleoptera*).

By Thomas G. Sloane. Communicated by H. E. Andrewes, F.E.S.

[Read October 5th, 1921.]

Haliplidae.

Aube's statement in 1838 (Spec. Gen. Col., Dejean, vi, p. 3) that *Haliplus* has 11-jointed antennae is the earliest record of the number of these joints that I have seen, but all more recent authorities that I know give the number as ten (cf. Lacordaire, Gen. Col., 1854, i, pp. 410 and 411; Leconte and Horn, Class. Col. N. Am., 1883, p. 60; Ganglbauer, Käfer Mitt. Eur., 1892, i, p. 412). The idea of 10-jointed antennae for *Haliplus* must have originated between 1838 and 1854, and subsequently to the latter of these dates I have seen no question as to its being correct; but after carefully examining the antennae of *H. variegatus* Sturm, and *H. ruficollis* de Geer, I cannot make the number for these two species as other than eleven, a number consonant with the usual number in the sub-order Caraboidea. The joints of the antennae of *Haliplus* must always have been examined *in situ*, and it would confer a benefit on entomology if some skilled microscopist would detach an antenna of *Haliplus* from the head, and give an accurate drawing of it, showing the number of joints.

Paussidae.

In the genera of the tribes Cerapterini and Paussini of the family Paussidae, according to the books, the number of joints in the antennae is ten, seven, or two, but in all the genera of these tribes which I have been able to examine there is one more joint than the books say. This is a small (or very small) second joint, which is usually almost wholly received into the apex of the large basal joint, and which forms a rotula for the clava of the antennae. Though this little joint is overlooked, or ignored by modern authors, it actually exists. It was recorded for *Hylotorus* by Dalman in 1823 in his diagnosis of that genus (as quoted by Westwood in the Arcana Entomologica, ii, p. 40). Westwood, too, recognised its presence in 1843 in his diagnoses of the genera *Pentaplatarthrus* (*l. c.* 38), *Lebioderus* (*l. c.* 39), and *Platyrhopalus* (*l. c.* 74), and in his synoptical

table of genera (*l. c.* 5), where he says the antennae are *quasi* 10-, 6-, or 2-*articulatae*; but later, he must have lost his belief in its existence, to be followed by subsequent authors. I have seen this little joint in the genera of the tribes Cerapterini and Paussini which I have been able to examine, viz. *Cerapterus*, *Arthropterus*, *Ceratoderus*, *Platyrhopalus*, and *Paussus*, and believe it would be found in the other genera of these tribes. Recognition of this little second joint requires that the formula of the tribe Cerapterini be amended to—*antennae* 11- *or* 7-*jointed*; and that of the tribe Paussini to—*antennae* 7- *or* 3-*jointed*. It is to be noted that, unless one is prepared to deny the existence of the little true second joint, it is necessary to call the basal joint of the clava the third joint; it is now invariably called the second joint.

XV. *Observations on the Structure of some Australian* Lepidoptera Homoneura, *including the Diagnoses of two new Families.* By A. Jefferis Turner, M.D., F.E.S.

[Read October 5th, 1921.]

Text Figures 1–8.

The order *Lepidoptera* is naturally divisible into two sub-orders of very unequal size, but separable by important anatomical characters. In the *Homoneura* or *Jugata* (1) the neuration of both wings is substantially the same: (2) a jugum is developed at the base of the dorsum of the fore-wings as the chief, or at least a most important part of the wing-coupling apparatus: (3) the spiral proboscis or tongue so characteristic of the *Lepidoptera* is never developed. In the *Heteroneura* or *Frenata* (1) the neuration of the hind-wings is reduced by the radial sector being unbranched (Comstock and Needham, p. 81), so that three veins (R3, R4, R5) normally present in the fore-wing are never developed: (2) there is no jugum, but the frenulum of the hind-wings articulates with a special apparatus consisting of a subdorsal retinaculum in both sexes, and in addition a subcostal retinaculum in the ♂ sex, except in groups in which these structures have been lost. By "lost" I mean that these groups can be inferred with considerable certainty to have descended from forms in which these structures were present: (3) A spiral proboscis or tongue is present except in groups in which it has been lost. The absence of a proboscis in the *Homoneura* I imagine to be primitive and correlated with the fact that the group came into existence before the evolution of flowering plants.

I do not doubt that other important anatomical differences might be pointed out, but these appear to me to be sufficient, and this primary division of the *Lepidoptera* is, I think, generally accepted. The names *Jugata* and *Frenata* we owe to Comstock (p. 325). (They are sometimes written *Jugatae* and *Frenatae*, but *Lepidoptera Jugatae* is, of course, an impossible combination.) *Jugata* is a sufficiently suitable term for the group that it represents, but the term *Frenata* is definitely misleading, as a frenulum is present in many *Jugata*, which are in fact, as Tillyard (A., p. 298) has shown, jugo-frenate. I therefore prefer to adopt the more accurate terms of *Homoneura* and

Heteroneura, which have been proposed by the latter author. It is an error to suppose that the jugum is a more primitive structure than the frenulum. Both occur in other orders of insects. A jugal lobe similar to that of the jugate *Lepidoptera* is present in some *Trichoptera* and *Megaloptera*, while a frenulum occurs among the *Mecoptera* and *Planipennia*, and the primitive wing-coupling apparatus, from which all these modifications appear to have developed, seems to have been jugo-frenate (Tillyard, A., p. 312).

Recently Comstock (*l. c.*) has proposed to remove the *Micropterygina* from the *Lepidoptera Jugata*, and to unite them with the *Trichoptera*. While acknowledging their many points of relationship to that order, which suggest a common and not very remote origin, I agree with Tillyard (B., p. 132) that they are true *Lepidoptera*, differing from the *Trichoptera* in (1) the absence of M4 as a separate vein in the fore-wing: (2) the absence of the characteristic trichopterous "wing-spot": (3) the wholly different tracheation of the pupal wings: and (4) in the broad, striated, lepidopterous scales; while in the points on which Comstock relies they are at least as closely allied to the *Hepialidae* as to the *Trichoptera*.

Chapman (p. 310) has proposed to separate the genus *Micropteryx* as a new order, the *Zeugloptera*, leaving the other European genera among the *Lepidoptera*, mainly on account of structural differences in the female genital tube. However important these may be, and I confess that I am not fully competent to weigh their importance, they appear to me quite insufficient to justify the formation of a new order, nor should they close our eyes to the essential similarity between *Micropteryx* and the other genera in so many respects.

Not so long ago only two families were recognised in the *Homoneura*, the *Micropterygidae* and *Hepialidae*. I think we may now recognise six or seven. These comprise the three subfamilies into which Meyrick has subdivided the former group, which are, I consider, fully entitled to be regarded as separate families, and, more closely allied to the *Hepialidae*, the *Prototheoridae* lately described by him, and two new families to be described in this paper. With these introductory remarks I will proceed to my own observations.

Sabatinca calliplaca Meyr. is found in tropical rain-forest on hills near the coast of Queensland over an extensive

area. I have taken it, sometimes abundantly, at Montville (1500 ft.) behind Nambour, on Mt. Tambourine (1800 ft.), on the McIntyre Range in the National Park (3000 ft.), and have received it from Kuranda (1000 ft.) behind Cairns. By denuding * the wings of a number of specimens I have been able to obtain the sketch of the neuration shown in Fig. 1. In parts the veins are very fine and indistinct, and in some examples not traceable, these I have indicated by single lines, but in all these

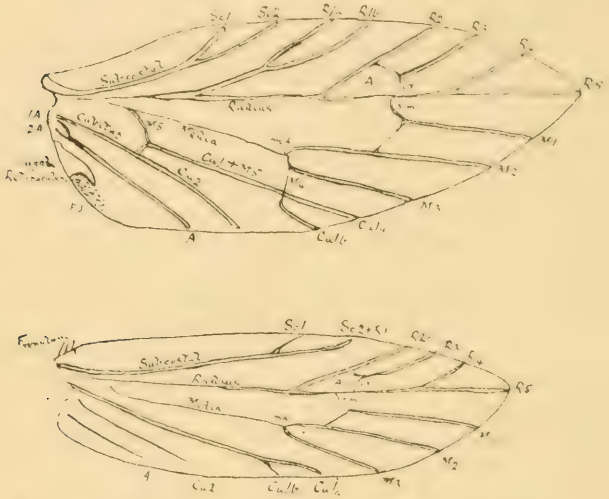


Fig. 1.—*Sabatinca calliplaca* Meyr. Fore- and Hind-wings.

instances the veins are visible in some examples under a low microscope objective. The veins indicated by a double contour are very distinct. The wing-coupling apparatus consists of a sharply deflexed jugal lobe (*r.*) at the base of the dorsum of the fore-wings, articulating with a group of bristles on the base of the costa of the hind-wings, which form a frenulum, as described by Tillyard. The dotted area in front of the jugum marks the position

* I have found chemically denuded preparations much more satisfactory than those prepared by mechanically removing the scales. The wings are dropped into spirit, transferred to Liq. Sodae Chlorinatae and immersed. At the right stage, which must be determined by careful watching with a lens, they are removed with a wooden paint-brush handle, and *floated*, not immersed, on water acidulated with acetic acid, from this coaxed on to a glass slide and dried.

of a group of strong hairs assisting in this articulation; I propose to call these the prejugal bristles (*p. j.*). In the fore-wing the humeral crossbar from the subcostal near its base to the costal margin, present in some species of *Sabatinca*, is not developed; the subcostal branches into Sc1 and Sc2, the first radial into R1*a* and R1*b*; the radial sector divides dichotomously; R5 runs to the apex of the wing; an inter-radial crossbar (*i. r.*) is present, completing the areole, which, as I have elsewhere insisted, is a primitive structure in the *Lepidoptera*. That the absence of a median cell is due to the absence of the inter-median crossbar consecutive to a distal position of the bifurcation of M1 and M2, is, I think, proved by Tillyard's figure (B., p. 106) of the pupal tracheation of the fore-wing of *Eriocrania*. It is a specialised form of reduction not, I think, found elsewhere among the *Lepidoptera*. The *Hepialidae* (Fig. 8) and several families of the *Heteroneura* like the *Cossidae* have in this instance preserved a more primitive structure. The media has three developed veins, together with a fourth (M4), which joins the cubitus at its bifurcation into Cu1*a* (really a conjoint vein Cu1*a* + M4) and Cu1*b*. Comstock (p. 314) regards this as a medio-cubital crossbar homologous with that found in the *Trichoptera*; but if the *Micropterygidae* are really lepidopterous, as I believe, it must be homologous with M4 as it occurs in the *Hepialidae* and *Heteroneura*. The basal connection of the media and cubitus by the posterior arculus, which Tillyard (B., p. 637) suggests may be a fifth branch of the media (M5), is very clearly developed. This is a primitive structure of which very little, if any, vestige remains in other groups of *Lepidoptera* in the neuration of the imago. The second branch of the cubitus is seen arising directly from its main stem. Unfortunately by most authors, including Comstock (*l. c.*), this branch together with the main cubital stem have been mistaken for the first anal. The first and second anals are represented by a short loop at the base of a conjoint vein. The third anal I have not been able to distinguish.

The neuration of the hind-wing is very similar to that of the fore-wing with some not unimportant differences due to reduction. The subcostal is branched, but R1 appears to be so completely absent that no trace remains to show what has become of it. The clue to its mode of disappearance is shown in a denuded example of *Sabatinca*

aurella Philpott, of which species I have dissected several examples kindly sent to me by Mr. A. Philpott. In this (Fig. 3) the termination of R1 is seen in some instances running into Sc2, in other examples it is wholly absent as in *calliplaca*. In *S. chrysargyra* Meyr. according to a figure by Tillyard (A., p. 117), which I have copied (Fig. 3), R1 is traceable throughout. It is therefore evident that in this genus R1 of the hind-wings is unbranched, that it runs into Sc2, and that its basal portion

Fig. 2.—*Sabatinca aurella* Philpott.
Part of Hind-wing.

is often obsolescent or obsolete. The remaining radial veins and the areole are exactly as in the fore-wings. The only difference in the median veins is the absence of M4. It is absent also in my examples of *aurella*. As M4 in these species is very feebly represented in the fore-wings, I do not think its absence in the hind-wings is an important character. The basal portion of the media is very feebly developed, and the posterior arculus cannot be traced.

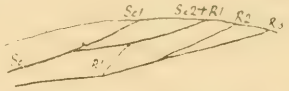


Fig. 3.—*Sabatinca chrysargyra* Meyr.
Part of Hind-wing (after Tillyard).

Cu2 and a solitary anal vein are very feebly developed, and their basal connections not discernible.

If we compare the neuration of *S. calliplaca* with those of some of the larger New Zealand species as given by Meyrick (A.) and Tillyard (*l. c.*) we find, apart from the variations of R1 of the hind-wing already noted, that the former lacks the humeral bar in the fore-wing, and that there has been a reduction in the anal veins. Whether these differences are of generic value could be decided only by an exhaustive examination of the New Zealand species. For the present, at any rate, we must retain *calliplaca* in the genus.

I have found the study of the mouth-parts difficult.

The mandibles are easily seen in microscopical preparations, but I have not obtained any preparations showing satisfactorily the structure of the maxillae and labium. In Fig. 4 I have sketched the mandibles, the five-jointed maxillary palpi, and the very short three-jointed labial palpi, which bear some terminal bristles on the third segment. The antennae consist of short joints bearing

Fig. 4.—*Sabatinca calliplaca.* Mandibles, labial palpi, and one maxillary palpus in situ. (Semi-diagrammatic.)

numerous bristles, and are closely similar to those of *Micropteryx aruncella*. In *S. aurella* the joints are longer, but otherwise their structure is the same. These antennae are primitive, inasmuch as there is no differentiation between dorsal and ventral surfaces, the bristles occurring in complete whorls. There are no fine cilia, and there appears to be no differentiation between the sexes. The posterior tibiae have two pairs of spurs, but the middle tibiae are without spurs; both are finely spinose, and in both some of the spines are apical.

Fig. 5.—*a*, *Sabatinca calliplaca*. Antennal segments. *b*, *Sabatinca aurella*. Antennal segments.

Sabatinca must be referred to the *Micropterygidae* (*sensu stricto*). It is more primitive than *Micropteryx* in the branching of R1 of the fore-wing, and of Sc of the hind-wing, but is specialised in the fusion of R1 of the hind-wing with Sc2 and partial or complete loss of its basal part.

I have a second species of *Sabatinca* from Queensland, which appears to have exactly the same neuration as *calliplaca*. It is—

Sabatinca sterops, n. sp. (*στέροψ*, flashing, dazzling).

♂ ♀. 6–9 mm. Head ochreous. Antennae whitish-ochreous, with a dark-fuscous ring at about ⅓. Thorax shining pale-yellow. Abdomen pale-grey, in ♂ ochreous tinged. Fore-wings narrowly elongate-oval; shining pale-yellow; three dark-fuscous dots on costa, near base, at ⅛, and on middle; a similar smaller dot in middle of disc between first two costal dots; a dark-fuscous streak from mid-dorsum obliquely outwards towards third costal dot, but not reaching beyond middle of disc, broad on dorsum; a round, shining, brassy blotch before apex reaching from costa to dorsum; cilia shining pale-yellow. Hind-wings broadly lanceolate; cilia 1; pale-grey; cilia pale-grey.

North Queensland: Kuranda, near Cairns, in June, Innisfail in November; Mourilyan Harbour, near Innisfail, in July; six specimens.

While camped at an altitude of 3000 ft. in the Queensland National Park in the McIntyre Range, among luxuriant rain-forest, consisting of dense jungle with large numbers of tree-ferns, between Dec. 27th, 1920, and Jan. 3rd, 1921, I took a small moth, which promised to be of great interest. It appears to be of lethargic habit, and I did not see it on the wing. Four specimens in all were secured (one of these has since been dissected) by sweeping the foliage of certain ferns and climbers attached to tree-trunks, or by beating the long sprays of moss hanging from twigs. The neuration of this species, to which I give the generic name *Palaeoses*, is shown in Fig. 6. The fore-wing is provided with a small acute jugal lobe, which is not deflexed, but projects downwards nearly in the same plane as the wing, and there is no frenulum on the hind-wing. The wing-coupling is therefore jugate, and of the same structure as occurs in the *Hepialidae*. In the fore-wing the subcostal gives off a short humeral cross-bar to the costa near the base of the wing, and divides into Sc1 and Sc2, the former vein being very short. R1 is undivided, and the radial sector divides dichotomously, but its lower branches are deflected dorsad, so that R3, R4 and R5 run to the termen, while R2 reaches the costa shortly before the apex. In this it contrasts sharply with *Sabatinca* and with most *Lepidoptera* except the *Hepialidae*, in which the terminal ending of these veins is a usual character. There is no inter-radial, so that the areole is undeveloped. The media arises out of the cubitus, the bases of these

veins being fused for a considerable distance; and there is no trace of the posterior arculus. There is no median cell, but on the analogy of *Anomoses*, as will be shown presently, I assume that its absence is due to the loss of the upper primary branch of the media, not to the loss of the intermedian as in *Sabatinca*. The three median veins are well-developed, but there is no trace of M4, which should unite the media with Cu1*a*. As a consequence the lepidopterous cell is left open, but a spurious cell, very much resembling it, is bounded beneath by the media and its lower primary branch. The cubitus divides into Cu1*a*

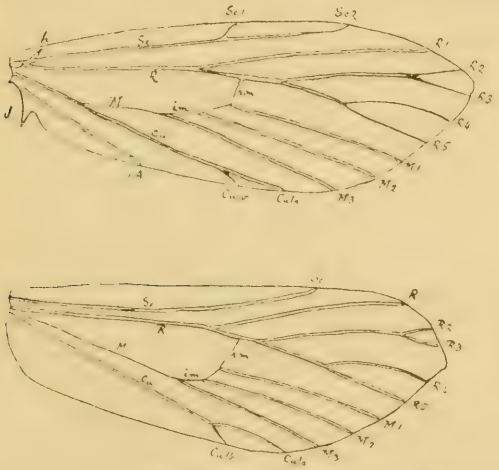


Fig. 6.—*Palacoses scholastica* Turn. Fore- and Hind-wings.

and Cu1*b* very near its termination, the latter vein being short and weak, but there is no trace of Cu2. There is a solitary anal vein with no U-loop at its base. The neuration of the hind-wing differs only in the absence of the humeral cross-bar, the absence of branching of the subcostal, and the absence of any anal vein, although the anal area of the wing is rather large. The structure of the antennae is of primitive undifferentiated type as in *Sabatinca*. Mandibles and maxillary palpi are absent, but the labial palpi are fairly large and covered with rather long hairs. Tibial spurs are absent as in the *Hepialidae*.

Before discussing the systemic position of this curious

form, it will be well first to consider the structure of *Anomoses* Turn. (p. 391). As this at present consists of a unique type, it cannot be dissected, but by careful denuding of the underside of the wings with a small brush moistened with spirit I have been able to make a trustworthy sketch of its neuration. A small pointed jugal lobe, not deflexed, is present as in *Palaeoses*. There are a large number of fine bristles or hairs from the costa of the hind-wing near its base which may represent a frenulum, and the same thing may be noted of *Palaeoses*, and is recorded by Meyrick (*l. c.*) in *Protolheora*. In neuration *Anomoses* has suffered less reduction, but shows

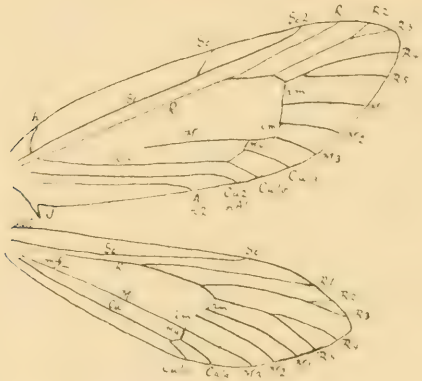


Fig. 7.—*Anomoses hyloeeetis* Turn. Fore- and Hind-wings.

a structure from which that of the former genus may have been evolved. In the fore-wing the subcostal and radial veins show no difference, except that R3 ends just on the costal side of apex. The media is unbranched, and cannot be traced back far, but M4 is distinct and completes the lepidopterous cell. There are two internal veins, whose basal connections I have not been able to make out, and I am uncertain whether they represent Cu2 and A1, or A1 and A2. In the hind-wing M4 can again be distinctly seen. The media is most interesting, for the primary median fork (*m. f.*) has been preserved and is quite near the base of the wing; the upper branch of the media is obsolete except at its extreme base; if this had been completely lost the result would have been the condition observed in the fore-wing, and in both wings of

Palaeoses, and I believe it is in this way that they have evolved. I can detect no internal veins in the hind-wing, but as this part of the wing is very difficult to observe in my solitary example, I cannot say whether any are present or not.

In *Anomoses* the antennae, which are very short ($\frac{1}{4}$), are primitive with whorls of fine bristles. The labial palpi are rather long, and covered with long hairs. The posterior tibiae have two pairs of long spurs; the middle tibiae, which are densely scaled, have a pair of rather short terminal spurs. I can discover no mandibles, but it is impossible to say that they may not be concealed by hairs. In my original description (Turner, p. 391) I

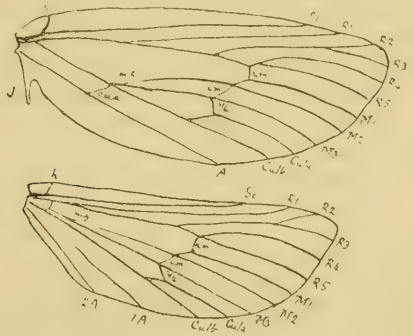


Fig. 8.—*Fraüs crocea* Luc. Fore- and Hind-Wings.

stated that the maxillary palpi were "long, folded." I can detect what may be not long, but rather short maxillary palpi concealed by hairs, but am not sure of their existence.

We are now in a position to discuss the affinities of *Anomoses* and *Palaeoses*. We will commence with the former. In spite of the presence of tibial spurs and the structure of the antennae, both Micropterygid characters, the neuration shows that it has closer affinities with the *Hepialidae*. This may be understood by a comparison with the neuration of *Fraüs crocea* Luc. (Fig. 8). No stress can be laid on the forking of the fore-wing subcostal, as this, though rare in the *Hepialidae*, occurs in *Sthenopis* (Comstock, p. 329); nor on the absence of any forking of R1 in the fore-wing, as this vein is single in *Micropteryx*. The Hepialid characters are (1) the absence of the interradial and consequently of the areole: (2) the dorsad

deflection of the last two or three radial veins: (3) the basal forking of the media in the hind-wing: (4) the presence of an inter-median: (5) the fusion of the bases of the media and cubitus in the fore-wing (not indeed discernible in my example of *Anomoses*, but evident in *Palaeoses*), with the absence of the posterior arculus. That it cannot be included in the *Hepialidae* we may infer from (1) the absence of the characteristic angular junction of M4 and Cu 1*a*: (2) the obsolescence of the upper primary fork of the media: (3) the absence of the cross-bar between the cubital and anal veins (Cu*a*) which appears to be constant in that family: (4) the presence of tibial spurs. It comes nearer to the *Prototheoridae* in which Cu*a* is not developed, and tibial spurs are present. From Meyrick's description (B., p. 17) and Tillyard's figure (B., p. 618) of *Prototheora* we may infer a real relationship between the two genera, but *Anomoses* differs (1) in the vein M1 and the basal part of Cu1*a* being almost in the same line, not angled, a character I consider of much importance: (2) in the loss of the upper primary branch of the media: (3) in the absence of any U-loop at the base of the anal vein of the fore-wing. Taken together these characters seem sufficient for the separation of a new family, the *Anomosetidae*. Should further material show the absence of mandibles, possibly also of maxillary palpi in *Anomoses*, this conclusion will be strengthened. It is possible, however, that intermediate forms may be discovered compelling the merging of the two families. We may define the family as follows.

Fam. ANOMOSETIDAE, nov.

Mandibles absent ?. Maxillary palpi present ?. Labial palpi well-developed. Antennae very short, with whorls of bristles. Posterior tibiae with two pairs of spurs; middle tibiae with terminal spurs. Fore-wings with two internal veins, cell closed, internal vein of cell single, 2, 3, 4, 5, 6, separate, parallel, discocellulars not angled at origin of 3, no areole, 7 and 8 stalked and running to termen, 9 and 10 long-stalked, 11 not branched, 12 giving off a branch to costa, and with a humeral cross-bar near base. Hing-wings similar (? internal veins), but internal vein of cell with a basal fork indicated, 12 not branched and without humeral cross-bar. Wing-coupling by a non-deflexed jugum on base of dorsum of fore-wing.

With regard to *Palaeoses* the case is clearer. The much reduced neuration and the absence of mandibles, maxillary palpi, and tibial spurs entitle it to family rank. These differences may indeed have been evolved from a form resembling *Anomoses* by a simple process of reduction, and I consequently regard the *Palaeosetidae* as derived from the *Anomosetidae*. It only remains to describe the new family, genus, and species.

Fam. PALAEOSETIDAE, nov.

Mandibles and maxillary palpi absent. Labial palpi well-developed. Antennae with whorls of bristles. Tibiae without spurs. Fore-wings with a single anal vein, 1 absent, 2 and 3 long-stalked, cell open between 3 and 4, internal vein of cell single, 4, 5, 6 separate and parallel, 7 and 8 stalked and running to termen, 9 and 10 long-stalked, 11 unbranched, 12 giving off a branch, and also with a humeral cross-bar near base. Hind-wings similar but without anal vein, subcostal not branched, and without humeral cross-bar. Wing-coupling effected by a non-deflexed jugum from base of dorsum of fore-wing.

Gen. PALAEOSES, nov. (*παλαιός*, ancient, *σής*, a moth).

Palpi moderate (about 1), porrect, expanded with long rough hairs towards apex, terminal joint concealed. Antennae very short (about $\frac{1}{6}$), similar in both sexes. Fore-wings with vein 9 to termen.

Palaeoses scholastica, n. sp. (*σχολαστικός*, sluggish).

♂ ♀. 14–18 mm. Head, palpi and thorax fuscous with some pale-ochreous irroration. Antennae fuscous, basal joints partly pale-ochreous. Abdomen fuscous; tuft large. Legs fuscous, irrorated, and tarsi annulated with pale ochreous. Fore-wings elongate-triangular, costa gently arched, apex round-pointed, termen long, bowed, oblique; fuscous, sparsely irrorated with pale-ochreous scales, more densely on dorsal and terminal margins; cilia fuscous, with indistinct pale-ochreous bars containing dark-fuscous points. Hind-wings subovate, rather narrow towards base, broadly expanded distally, apex round-pointed, termen rounded; cilia $\frac{1}{2}$; fuscous; cilia fuscous.

QUEENSLAND: National Park (3000 ft.) in December and January; three specimens.

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THE

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

1921.

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1921-1922.

The following poem on the entrance of The Entomological Society of London into its new home was specially written for the occasion by Professor Selwyn Image, M.A., and was read by the President at the General Meeting held on March 16, 1921.

THE ENTRANCE OF THE ENTOMOLOGICAL SOCIETY OF LONDON INTO ITS NEW HOME, March 2, 1921

Long time in home not ours we've patient dwelt,
Or vainly voiced those inmost yearnings felt
For some far worthier site, at last our own,
Where we might house thee, Mistress; where atone
For a dull world's neglect, that passed thee by
Alas! such ages with scant courtesy.
Years gone thy servants made demand by right
Of Powers that were to note thy straitened plight,
And grant thee a refuge seemly, as might be
A decorous shrine for service due to thee.
O most insensate World, of eyesight blurred
To Nature's Truth and Beauty—jostling herd
Of purblind fawners on but name or place—
No more, thank Heaven, now need we pray your grace
For our fair Mistress rest to find at length,
And lead her votaries on from strength to strength.
Nay, of themselves they've found, and founded well,
A Home at last wherein she'll deign to dwell!
See, see, strait Winter yields to burgeoning Spring—
Young flowers are born, fond birds awake to sing!
Yea, all but heard the cuckoo's voice draws near,
And far-fled swallows brood on hastening here:
While heaven's pale sky of tremulous blue takes on
A tenderer glory from the lengthening sun,
And Psyche-Forms of gold beneath his ray
Roused from their sleep float up the greening way!
In such glad hour renascent lo! we come,
Aurelian Brothers, to our new-found Home:
What happier presage, say, could e'er there be
Than Springtide's greeting to our company?
Nor doubt but o'er us, though unseen, descend
The hailing Spirits of full many a Friend
Of years gone by. Great names their roll displays
From that first list of pre-Victorian days
Down to the last, whose loss we newly mourn,
Rapt hence, yet sure to no unmindful bourne.

By their brave triumphs, searching ardour, fired
Gird we our loins to crown what they desired
In yet more knowledge and yet more, as now
With ampler means we ampler gains must show :
Nor idly bide, whilst Nature day by day
Out from her store exhaustless yields display
Of Beauty and Wisdom in close concert blent
To work for her Life's endless Wonderment.
So runs our dream, our prayer, our heart's desire :
Our wills, great Goddess, with but strength inspire !

S. I.

March 14, 1921.

THE

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

FOR THE YEAR 1921.

Wednesday, February 2nd, 1921.

The Rt. Hon. Lord ROTHSCHILD, M.A., D.Sc., F.R.S., etc., President, in the Chair.

Nomination of Vice-Presidents.

The PRESIDENT announced that he had nominated Mr. G. T. BETHUNE-BAKER, F.L.S., F.Z.S., Mr. J. HARTLEY DURRANT, and Comm. JAMES J. WALKER, M.A., R.N., F.L.S., as Vice-Presidents for the ensuing session.

Appointment of Finance, Publications, and Library Committees.

He also announced the formation of the three following Committees in place of the Business Committees, and the names of the Fellows appointed to serve thereon in addition to the Executive Officers.

(1) *Finance* :—Messrs. R. ADKIN, E. C. BEDWELL, G. BETHELL, G. T. BETHUNE-BAKER, Dr. H. ELTRINGHAM, Dr. GUY MARSHALL, Mr. W. G. F. NELSON.

(2) *Publications* :—Messrs. G. T. Bethune-Baker, J. C. Collin, J. H. Durrant, the Rev. F. D. Morice, Prof. E. B. Poulton, H. Rowland-Brown, Comm. J. J. Walker.

(3) *Library* :—Messrs. G. Bethell, K. G. Blair, J. C. Collin, J. H. Durrant, S. Edwards, Rev. F. D. Morice, Mr. C. B. Prout.

Vote of Thanks to the Medical Society.

The President announced that the next meeting (March 2) would be held at 41, Queen's Gate, and proposed a vote of thanks to the Medical Society for their past courtesy and consideration; Mr. W. G. Sheldon seconded, and gave an outline of the history of the Society at Chandos St. This was carried unanimously.

Exhibitions.

Bionomics of Cimex hirundinis.—Mr. A. Bacot exhibited living specimens of *Cimex hirundinis* and stated that of a small number of specimens of this bug taken from a deserted house-martin's nest in October a male and female were kept in a gauze-covered box and given opportunities of feeding upon human blood. They fed sparingly, but as they showed no signs of breeding they were then placed in a cool room at 10° C. and subsequently transferred to a cold room at about 0° C. After a month they were brought to room temperature, and then kept at 28° C. and afforded opportunities of feeding on man. They fed more vigorously than hitherto, and were observed to pair frequently. The female increased considerably in bulk as though developing ova, but no eggs were laid. The insects were then given the chance of feeding on a pigeon, and were observed to take blood two or three times, while they also continued to feed on human blood as well. A few fertile eggs were laid, and the young bugs which hatched in due course accepted human blood, but had not fed on the pigeon. One of the young bugs had moulted.

Stridulating organs in Holocera, etc.—Dr. K. Jordan exhibited some specimens of the Saturniid genera *Holocera*, *Ludia* and *Orthogonioptilum*, and said :—

If the sexes of a species of insect differ in secondary char-

acters, it is usually the male which is the more advanced or complex, apart from such special structures which serve the welfare of the offspring, as for instance the anal wool of many female moths and the long rostrum of some female weevils. We are so accustomed to find that it is the male which has a stridulating organ, or a scent-organ, or more strongly pectinated antennae, etc., that exceptions come as a surprise. In the literature on organic evolution, that which is usual is frequently taken as expressing a general law. The exceptions, however, prove that we have to deal with adaptations which appear again and again only as long as circumstances require or permit it. Like the human laws, the direction which evolution takes depends on internal and external factors and is not fixed as is often maintained ("Orthogenesis"). In this connection the exceptions from the usual are of great interest. The African Saturniids exhibited may serve as an illustration. The females of *Holocera* and *Ludia* have a kind of stridulating organ which is absent from the males. The underside of the fore-wing bears before the tornus a large area of peculiarly modified scales, which are so twisted that their surfaces are more or less vertical on the wing, the scales presenting the anterior and apical edges to the observer. On the hind-wing the corresponding portion of the costal margin is incrassate and bears a variable number of spikes, which stand upright and scrape on the fore-wing when the wings are in motion. Although entomologists who have handled live specimens do not seem ever to have heard the moth produce a sound, the apparatus has the appearance of a stridulating organ. The sound may be imperceptible to the human ear.

Dr. K. Jordan further exhibited two species of *Graphipterus* from Algeria and demonstrated the stridulating organ which Pocock has described in Ann. Mag. N. H. (7), x, p. 154 (1902). *G. rotundatus* Klug (1830) is common in the sandy desert and frequents the hillocks of loose sand crowned by bushes of *Limoniastrum* or *Tamarix*. On the Central Plateau of Algeria, at Guelt-es-Stel, we found a small-spotted form, *G. peletieri* Casteln. (1847), in association with *Cicindela truquii* Guér. (1855). The resemblance between the *Cicindela*

and the *Graphipterus* is very slight in the cabinet, yet they could not be distinguished when they sped through the low herbage under the glaring sun.

Dr. C. J. Gahan remarked upon the great interest of the discovery of stridulatory organs in the female of *Henucha*, and the fact that they were not present in the male. The only other instance known to him in which these organs appeared to be confined to the female sex was that of *Phonapate* —a genus of beetles of the family Bostrichidae. In reference to *Graphipterus variegatus* Klug, he said that although stridulation in that species had been made known by Lefebvre in 1832, and referred to by Lacordaire in his "Genera des Coleoptères," their observations had escaped his notice until after the publication of his paper on the Stridulating Organs of Coleoptera, in the Society's Transactions for 1900. He had also overlooked an interesting paper by Dr. K. Escherich on the Anatomy and Biology of *Paussus turcicus* Friv. (Zool. Jahrb. 1898), in which stridulatory organs present in that species are described and figured. Quite recently, when investigating the characters of some types of Paussidae, he had independently noticed the existence of stridulatory organs in the genus *Paussus*, and found them present in every species of that genus which he had examined, as well as in the allied genus *Hylotorus* Dalm. In both of these genera, there is on each side of the base of the abdomen an arcuate series of short, sharp ridges, while near the apex of each hind femur, on the dorsal side, is a small file-like area, which is scraped by the ridges on the abdomen when the leg is rotated. In the two known species of the Paussid genus, *Platyrhopalopsis* Desneux, he found stridulatory organs also present, but there the file consists of a series of fine, closely-placed, and somewhat radiating striae on each side of the metasternum, and the scraping of the file is effected by one or two small teeth or tubercles set on a protuberance near the base of the femur of the middle leg. A third species had been added to the genus by Canon Fowler; but this species was without stridulatory organs, and he was, therefore, not surprised to learn from Father Wasmann that, on quite other grounds, Fowler's species had already been removed from the genus

Alfred Robinson, photo.

A MIGRATORY FLIGHT AT BUKIT KUTU, SELANGOR, F.M.S. : MARCH 1920.

Three *Delias* (1–3), three Geometrids (4–6), one Chalcosiine (7).

Explanation of Plate A.

Fig. 1. *Delias ninus* Wall.: one of the 5 males.

2. ,, *pyramus* Wall.: one of the 3 males taken with 1 female. The pattern is similar in the sexes, but the female is larger.

3. ,, *aglaia* L. f. *parthenope* Wall.: the single male captured.

4. *Dysphania* (*Euschema*) *glaucescens* Walk. (Geometridae Hemitheinae): one of the 4 males taken with 2 females. The patterns are similar.

5. ,, (*Euschema*) *militaris* L. f. *selangora* Swinh.: the single male taken.

6. ,, (*Euschema*) *excubitor* Moore, probably a form of *subrepleta* Walk.: the single male taken.

7. *Psaphis camadeva* Dbl. (Zygaenidae, Chalcosiinae): the single male taken.

7*a*. Under surface of 7, showing, in the yellow pattern of hind-wing, incipient mimicry of *Dysphania*.

7*b*. A female of *P. camadeva* from Java, showing the mimicry of *Dysphania*, especially *D. excubitor*, fig. 6.

Platyrhopalopsis. He believed the presence or absence of stridulatory organs to be a character of considerable systematic importance within the limits of a family, and what little he had observed in the Paussidae tended to confirm him in that belief.

Rare Locust from Costa Rica.—Mr. O. E. Janson exhibited a fine and perfect specimen of *Markia hystrix*, Westw., a rare and remarkable locust received from Costa Rica, and directed attention to its evident protective characters in its curious cryptic coloration and the strongly spinose armature of the head, pronotum and legs.

Pierine Butterflies and mimetic moths migrating from one valley to another in Selangor, F.M.S.—Prof. Poulton exhibited the whole of the captured examples of the morning and evening migrations at Bukit Kutu described in Proc. Ent. Soc. Lond., 1920, p. lxiii. The eight additional specimens kindly sent by Mr. A. R. Sanderson and Mr. T. R. Harvey, included another species of *Delias* and also of *Dysphania*. The complete series of nineteen was as follows :—

Delias ninus Wall.,—5 ♂. *Delias pyramus* Wall.,—3 ♂, 1 ♀. *Delias aglaia* L., f. *parthenope* Wall.,—1 ♂. *Dysphania* (*Euschema*) *glaucescens* Walk.,—4 ♂, 2 ♀. *Dysphania* (*Euschema*) *militaris* L., f. *selangora* Swinh.,— 1 ♂. *Dysphania* (*Euschema*) *excubitor* Moore, probably f. of *subrepleta* Walk.,— 1 ♂. *Psaphis* (*Canerkes*) *camadeva* Dbl.,—1 ♂.

To this series a female of *P. camadeva* from Java had been added in order to show the perfection of the mimetic resemblance to *D.* (*E.*) *excubitor*. One of the additional specimens now received thus verified the prediction ventured upon in the 1920 Proceedings (p. lxiv) :—

"Although during flight, the female *P. camadeva* would resemble *D. glaucescens* and, far more closely, *D. militaris*, it was probable that the better model *D. subrepleta* and perhaps other Dysphanias would be found to accompany the *Delias* in their migratory flights in Selangor."

And now *excubitor* (believed by Mr. L. B. Prout, who had kindly made this determination and verified the other species of *Dysphania*, to be a form of *subrepleta*) was shown

to have been captured in the migrating stream, between March 5 and 13, 1920.

It was to be observed that there were only three females among the nineteen specimens captured—one of *Delias pyramus* and two of *Dysphania glaucescens*. It was not unlikely that the proportion would have increased at a later date, or perhaps during wet weather. Certain hitherto unpublished observations supported the conclusion that female Lepidoptera, butterflies as well as moths, migrated in large numbers in these latter conditions.

J. Röber, writing "On Mimicry and Allied Phenomena in Butterflies" (Entom. Mitteilungen, Bd. x, No. 1, Jan. 5, 1921, p. 23), reversed the usual interpretation and considered that "the *Dysphania* species might rather be considered as 'mimics,' because the widely distributed *Dysphania militaris* closely resembles an also widely distributed Anthrocerid (Zygaenid) *Canerkes euschemoides*, a protected species."

The relative rarity of *Psaphis* (*Canerkes*) compared with *Dysphania*, as shown in this migrating series and in collections generally, as well as the fact that the close resemblance in *camadera* is confined to the female, disproves Röber's suggestion and confirms the commonly accepted hypothesis.

A letter recently received from Mr. A. R. Sanderson contains the following additional information as to the conditions in which the exhibited specimens were captured :—

"Some of the specimens were taken in the mornings as well as the evenings, both by Mr. T. R. Harvey and myself, but I cannot say now in what proportions, as no records were kept at the time. When I say that the visibility was never at a maximum, I mean that the insects appeared in greatest numbers either before the sun was fairly up or when it was rapidly sinking in the evening. Dull evenings with promise of mist later on gave the best show I think and all the insects appeared to be in a desperate hurry to cross the ridge. Once the sun was well up only occasional stragglers were noticed. Very occasional specimens of *Delias* appeared on the crest during the day, but none were captured. These may have been odd ones which failed to get over the previous evening. This is, however, purely speculative."

A Hypsid moth inspected and neglected by Geckos.—Prof. Poulton exhibited a female *Hypsa* (*Asota*) *alciphron* Cram. (*caricae* F.), referred to in the following note written Nov. 21, 1920, from Kuala Lumpur, F.M.S., by Mr. W. A. Lamborn :—

"I was much interested to watch last night the attitude of some Geckos on the ceiling of my dining-room to some moths, the selection exercised being so very definite. The moth No. 28 sat for a very long time at one place, where three separate Geckos came up and inspected it, but passed by on the other side, not molesting it. Neither did the moth move at all. The Geckos made frantic rushes at other sitting moths, occasionally securing one, but many were too alert for them. Certain small moths, however, which made no attempt to escape were passed by. I must make a long handle to my net and secure a series."

Musca autumnalis De G. (corvina F.), hibernating as in previous years in a loft in the Isle of Wight.—Prof. Poulton said that he entered the loft at St. Helens on Dec. 16, 1920, and found many patches of flies. The numbers appeared to be greater than in any winter except that of 1914–15 when they were first observed. (Proc. Ent. Soc., Lond., 1915, p. xxi.)

Mr. H. St. J. Donisthorpe exhibited a number of workers of *Acanthomyops* (*Dendrolasius*) *fuliginosus*, all of which had workers of *Acanthomyops* (*Chthonolasius*) *umbratus* fastened by their mandibles on to their legs, etc. These ants were taken at Woking on August 27, 1915, when a fierce battle was taking place between the two species; the former endeavouring to turn the latter out of their nest, which was situated in the hollow base of a birch tree. All the *umbratus* were eventually killed, and the *fuliginosus* took possession of the tree. It seemed a good opportunity to note how soon the new nest became infested with Myrmecophiles, and consequently he had visited this tree from time to time from August 1915 to November 1920. During this five years some thirty species of Myrmecophiles have established themselves in the nest. The following is a list of the species taken (all of which Mr. Donisthorpe exhibited), and they are listed

in the order in which they were found, but only the dates of visits are mentioned when an additional species to the list was found.

Mr. Donisthorpe commented on some of the species, and also on the colony-founding of the ant.

Woking, August 27, 1915.

Battle between *A.* (*D.*) *fuliginosus* and *A.* (*C.*) *umbratus*.

1. *Myrmedonia lugens* } Running about among the ants.
2. „ *cognata* } These three species must have
3. *Phyllomyza lasiae* } followed the *fuliginosus*.

May 10, 1916.

4. *Myrmedonia laticollis*.
5. *Tropidopria fuliginosa*.

August 17, 1917.

6. *Scatopse transversalis* var.
7. *Amphotis marginata* and No. 2 also present.

March 19, 1920.

8. *Myrmedonia funesta*.
9. *Quedius brevis*.
10. *Microglossa gentilis*.
11. *Harpactes hombergi*.
12. *Apiochaeta aequalis*.
13. *Apiochaeta ciliata*.

April 4, 1920.

14. *Myrmedonia limbata* and Nos. 2, 8 and 9 also present.

May 30, 1920.

15. *Oxypoda vittata*.
16. *Ptenidium formicetorum*.
17. *Beckia albina*.
18. *Limosina curtiventris*.
19. *Loxotropa fuliginosi* Box, sp. n.
20. *Laelaps* (*Laelapsis*) *cuneifer* and Nos. 3, 8, 9, 10, and larvae of 9 also present.

June 20, 1920.

21. *Ptenidium laevigatum* and Nos. 3, 9, 10, 13, 14, and pupae of 9 also present.

22. Chalcid bred from *Quedius brevis* pupa.

August 14, 1920.

23. *Ceraphron fuliginosi* Box, sp. n., and Nos. 2, 3, 4, 6, 8, 9 and 16 also present.

September 27, 1920.

24. *Othius myrmecophilus.*

25. *Spalangia erythromera.*

26. *Lagynodes niger* var. *aterior* Box, var. n.

27. *Aspilota nervosa.*

28. *Tetrilus diversus.* Very young spiders and egg-sack on centre of nest.

29. *Quedius mesomelinus* and Nos. 2, 3, 8, 9, 11 and 14 also present.

November 4, 1920.

30. Eggs and pupae of Dipteron on centre of nest. The pupae are from larvae taken on November 4. Nos. 2, 3, 8, 9, 11, 14 and 27 also present.

Mr. Lachlan Gibb showed several female forms of *Chrysophanus dispar*, bred and reared by Capt. Bagwell-Purefoy, 1920, in his butterfly "house" at Maidstone, Kent. He finds that after eight years' breeding the upper sides of ♀ have become somewhat darker. The under sides have the bluish sheen on them like British *dispar* in contradistinction to French and Dutch examples, which are grey. But the broad orange band on underside has diminished.

Papers.

The following papers were read :—

"Notes on the Orthoptera in the British Museum. I. The Group of Euprepocnemini," by Dr. B. P. Uvarov.

"Notes on Synonymy and on some types of Oriental Carabidae in various foreign collections," by H. E. Andrewes.

Wednesday, March 2nd, 1921.

The Rt. Hon. Lord Rothschild, M.A., D.Sc., F.R.S., etc., President, in the Chair.

This being the first meeting held at the Society's new premises, 41, Queen's Gate, S. Kensington, S.W., the President delivered an address of welcome to the very large number of Fellows and Visitors present.

Election of a Fellow.

Mr. G. F. C. Willett, of Sipetong, British North Borneo, was elected a Fellow of the Society.

Exhibitions.

The President exhibited a number of gynandromorphous Lepidoptera, in most cases accompanied by the normal ♂♂ and ♀♀ of the species. Of special interest were a half and half gynandromorph of the vapourer moth (*Orgyia antiqua*); one of the Aegeriid moth, *Sciapteron dispar* Stdgr.; and one of *Papilio* (*Troides*) *haliphron*. Of interest were also two British caught ♀♀ of *Colias croceus* (*edusa*), one having *helice* fore-wings and normal hind-wings; the other the right side *helice*, the left side normal.

List of Gynandromorphous Specimens Exhibited.

Papilio (*Troides*) *haliphron* Boisd. ½ and ½. Right ♂, left ♀. Patunuang, S. Celebes.

Papilio androgeus Cram. Mixed sexes on each wing. Sapucay, Paraguay.

Delias aruna Boisd. Mixed on each wing. Dutch New Guinea.

Appias figulina Butl. ½ and ½. Right ♀, left ♂. Mt. Tahan, Malay Peninsula.

Daptonura peruviana Luc. ½ and ½. Right ♀, left ♂. Pozuzo, Huanaco, Peru.

Euchlöe cardamines Linn. ½ and ½. Right ♂, left ♀. Epping Forest.

Hebomoia glaucippe Linn. ½ and ½. Right ♀, left ♂. China.

Terias puella Boisd. ½ and ½, a few streaks of ♀ colour in ♂ hind-wing. Right ♂, left ♀. Trobriand Islands.

Teracolus phlegyas Butl. Mixed, left hind-wing ♂, remaining wings mixed. Huasch River, Abyssinia.

Teracolus eucharis Fabr. ½ and ½. Right ♂, left ♀. Coumbatore, India.

Gonepteryx cleopatra Linn. (1) Almost complete ½ and ½, some ♀ colouring on right hind-wing and ♂ colouring in costal area left fore-wing. Right ♂, left ♀; Dalmatia. (2) Hind-wings ♀, fore-wings mixed. Dalmatia.

Archonias pharnakia Fruhst. ½ and ½, a little ♀ colour on light patch of right fore-wing. Right ♂, left ♀.

Colias lesbia Fabr. ½ and ½. Right ♀, left ♂. La Soledad, Argentina.

Colias croceus Fourcr. (= *edusa* Fabr.). ♀. Fore-wings ab. *helice*, hind-wings *croceus*. ♀. Right half ab. *helice*, left half *croceus*.

Pararge maera Linn. ½ and ½. Right ♂, left ♀. Hyères, S. France.

Ithomia gonussa Hew. ½ and ½. Right ♀, left ♂. Bogota.

Melitaea didyma Esp. ½ and ½. Right ♂, left ♀. St. Martin de Vésubie, Alpes Maritimes.

Charaxes castor Cram. ½ and ½. Right ♂, left ♀. Mikindani, Tanganyika Territory.

Charaxes marmax Westw. ½ and ½. Right ♂, left ♀. Sikkim.

Apatura vacuna Godt. ½ and ½. Right ♂, left ♀. Paraguay.

Limenitis populi Linn. ½ and ½. Right ♀, left ♂. Engersdorf, Austria.

Anaea morpheus Stdgr. (1) ½ and ½. Right ♀, left ♂. Paraguay. (2) Left ½ fore-wing mixed, hind-wing ♀; right ½ ♂. Paraguay.

Chrysophanus rutilus Wernb. ½ and ½. Right ♂, left ♀. Bred from ova of ♀ *ex* Austria.

Polyommatus icarus Rott. ½ and ½. Right ♀, left ♂. Ventnor, I. of Wight.

Amorpha populi Linn. (1) ♂ and ♀. Right ♂, left ♀. Bexley, Kent. (2) ♂ and ♀. Right ♀, left ♂. Köepenick, Berlin.

Cosmotriche potatoria Linn. Almost ♂ and ♀. Right ♀, left ♂ with slight ♀ coloration. Great Britain.

Dendrolimus pini Linn. ♂ and ♀. Right ♀, left ♂. Lichterfeld, Berlin.

Dendrolimus excellens Butl. ♂ and ♀. Right ♂, left ♀. Bred Berlin, *ex* Japonia.

Lasiocampa quercus Linn. ♂ and ♀. Right ♀, left ♂. Great Britain *ex* Webb coll.

Orgyia antiqua Linn. ♂ and ♀. Right ♂, left ♀. Larva Silesia, bred Berlin.

Saturnia pavonia Linn. (1) ♂ and ♀. Right ♀, left ♂. Wiesbaden. (2) ♂ and ♀. Right ♂, left ♀. North Germany.

Telea polyphemus Cram. ♂ and ♀. Right ♂, left ♀. Baltimore.

Rothschildia orizaba Westw. ♂ and ♀. Right ♂, left ♀. Bred Elberfield, *ex* Mexico.

Actias artemis Brem. ♂ and ♀. Right ♀, left ♂. Sidemi, Amurland.

Brahmaea ledereri Rog. ♂ and ♀. Right ♂, left ♀. Cilicia.

Dicranura vinula Linn. ♂ and ♀. Right ♂, left ♀. Posen, Prussia.

Sciapteron dispar Stdgr. ♂ and ♀. Right ♂, left ♀. Guelt-es-Stel, C. Algeria.

NOTES ON THE MIGRATION OF LEPIDOPTERA, WITH A SUGGESTION AS TO THE CAUSE OF THE BACKWARD AND FORWARD FLIGHT OCCASIONALLY OBSERVED.—Prof. POULTON said that ever since the receipt of Mr. A. R. Sanderson's observations on the morning and evening flight of *Delias* and the associated moths at Bukit Kutu (Proc. Ent. Soc. Lond., 1920, p. lxiii; 1921, p. v) he had been thinking about the curious facts, and had at last hit upon a probable explanation. It was briefly this—(1) that the direction of the migratory flight of certain species and in certain localities was determined and kept up by a sensitive relationship to the wind-current; and (2) that, if such a migrating stream reached a locality where the morning and evening wind blew in opposite directions, this

delicate susceptibility would bring about a corresponding reversal in the direction of flight. Thus if the direction were against the wind in the morning it would still be against it in the evening.

It seemed worth while to bring forward a few general considerations upon the whole subject.

The Liberation of the Emigratory Instinct.—This subject was treated in Trans. Ent. Soc. Lond., 1902, pp. 462–465, as a further development of the views of Roland Trimen in "South African Butterflies," vol. i, 1887, pp. 31, 32. The quoted sentences in the following statement were from the former publication.

"The instinct to emigrate * probably exists in a dormant state in all species liable . . . to outrun the food-supply in any part of their range." And the frequency with which the instinct is called into play in *Pierinae* is probably connected with their larval food-plants as well as with their power of multiplication; but the arresting appearance of a swarm of Pierines must also be taken into account as one cause of the numerous records. The stimulus which evokes the instinct must be the want of food-plant, or rather, the presence of food-plant useless to the future larvae. And such uselessness, although often caused by larval attack, may be also caused by drought. In either case there is aroused "the imperative instinct to move"—an instinct which often "further compels the individuals to move together in vast masses in the same direction, rather than to scatter and fly in all directions." Thus it is "that the limits of the normal range of the species may be overpassed; that areas from which the species has been driven may be regained:—not by single individuals or by a very few pairs, but by immense numbers of both sexes. . . ." And, although the crowds may often only reach a foodless desert or the sea, the instinct is still advantageous in that it removes individuals which at the time are a danger to the community. For the overcrowding, if

* These movements are, for the most part, better spoken of as "emigration" rather than "migration," because the central fact is the flight of vast masses of individuals *out of* an overcrowded area (*ibid.*, p. 465).

not checked, may threaten the welfare or perhaps the existence of the food-plant over a wide area.

The cause here spoken of may operate and the instinct to emigrate may be liberated every year or only in exceptional years. Thus *Libythea labdaca* Westw., appears to migrate so regularly in S. Nigeria that Mr. C. O. Farquharson wrote to me (May 3, 1917): "In some places the natives take the appearance of the migrants as a sign that the planting season for such crops as maize and other annuals has begun, which is equivalent to saying that the rains have definitely set in." On the other hand, the Rev. K. St. Aubyn Rogers records that, near Mombasa, *Libythea laius* Trim., and other butterflies (*Catopsilia florella* F., is, however, an annual migrant) appear only in occasional years (1899 and again in 1911) after a period of prolonged and severe drought. Mr. Rogers concluded "that butterflies which are usually non migrants may be stimulated by abnormal conditions to become migrants" (Proc. Ent. Soc. Lond., 1912, pp. xcvii–xcix).

The view here adopted—that the exhaustion of the larval food-plant is the essential cause of migration—is, I believe, the opinion usually held. It is certainly the one suggested by Col. N. Manders in Trans. Ent. Soc., 1904, pp. 705, 706, by Boisduval as quoted by Herbert Druce in "Biologia Centrali-Americana," Heterocera, ii, p. 3, by Spruce in Journ. Linn. Soc., Zool., ix, pp. 355–357, and by Roland Trimen in "South African Butterflies," vol. i, 1887, p. 32, *n.* 1.

Evidence that the food-plant is actually exhausted at the time of migration and over part of the area traversed is brought forward by Spruce (*l. c.*), Manders (*ibid.*, p. 704), and Mrs. Barber as quoted by Trimen (*l. c.*). This latter evidence, obtained in Griqualand West in 1881, is especially valuable, as it is apparently an account of the condition which precedes and leads to the emigration of *Catopsilia florella*. The caterpillars had stripped the leaves from their food-plant *Cassia arachoides* "and then devoured the young shoots, and even the bark of the stems." Dr. G. A. K. Marshall, D.Sc., tells me that he has observed the same conditions in a Rhodesian valley, he believes on the road from Salisbury to Hartley, and here the emigration of *C. florella* had begun.

The Determination and Persistence of Direction in Flight.—It is clear that the steady flight in one direction which has been so often recorded involves something more than the liberation of the instinct. There must be some stimulus which determines and keeps the direction of flight. And the most usual stimulus is probably the wind-current.

Commander J. J. Walker has very kindly tabulated on pp. xx-xxv the data recorded by the late Mr. J. W. Tutt in "Ent. Record" (1898–1902), omitting those referring to *Pyrameis cardui* and *Danaida plexippus* and adding a few more recent observations. Among the references which give sufficient data it will be found that flight was against the wind eighteen times, with it nine times and across it four times. But these latter include Mr. C. B. Williams' many records from British Guiana (p. xviii). These facts support the conclusion that there may often be a definite relationship to the wind-current. The reaction to the stimulus probably differs in different species and in different parts of the world, being determined by natural selection based on local conditions.

Flight against the Wind.—This reaction may be doubly advantageous. A gentle current is obviously far more effective as a stimulus when flight is against rather than with it; furthermore, as Mr. A. W. Bacot suggested to me, steady flight against a wind flowing towards a hot dry area is pretty sure to carry an insect into a cooler, moister locality. This is the reaction we should expect to find especially common in countries where the food-plant is liable to be temporarily exhausted by drought over a large area, or by drought combined with larval attack.

Flight with the Wind.—It is probable that this reaction has been developed in localities where flight with a prevalent wind is more likely to carry the species to plenty than flight against it, *e. g.* for a butterfly which would be carried into a dried-up area by flying against a wind blowing across it.

Backwards and Forwards Flight.—It is obvious that a species which reacts to the wind-current in either of the above ways, but especially the former because of the greater sensitiveness already explained, will reverse its direction with each reversal

of the wind such as occurs diurnally in land- and sea-breezes near the coast. I am now able, by the kindness of Major Pendlebury, to bring forward a striking instance in which the cause and effect were observed.

Daily Migrations against a Land- and Sea-breeze by Pyrameis cardui, by W. le M. Pendlebury.

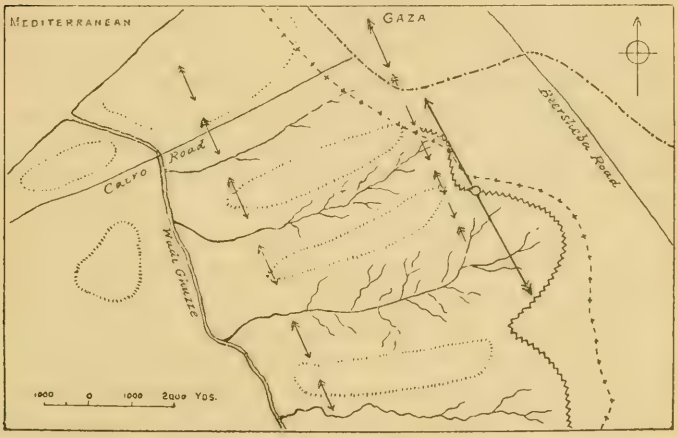
" Immediately after the second battle of Gaza, April 17–19, 1917, my observation-post was placed on the inner side of a ledge of cliff on the edge of cultivated land that lay between the British trenches round Gaza and the Turkish lines. I had been in the observation-post for about ten days when one morning at about 9.30 a.m. I noticed a cloud of *P. cardui* passing over me and going down towards the cultivation which was then green barley, with many flowers in it. The flight continued for about three-quarters of an hour. I was struck by their persistent appearance, and on the second day made a point of being there on the look-out. Almost at the same time as on the previous day they appeared again, flying in the same direction—N.W.—and in scattered bunches of 5–12 together. They also on this day continued to fly for about an hour, but towards the end of the time came singly or in twos and threes.

" In the late afternoon—5.30 p.m.—I was surprised to see the same species returning from the direction in which they had gone in the morning. They were not, however, nearly so numerous. My observations lasted for about ten days, and towards the end of that time it would be difficult to call the morning flight a migration, as the numbers were greatly reduced. In the early part of the time along ten yards of cliff the numbers averaged 40 a minute, which dwindled down to 10 a minute. After the first three or four days the numbers were about 20 a minute during the rush time, and the latter half of the ten days the average was 10 a minute. After that there were a few flying over casually but always in the same direction. The evening migrations towards the end of the time became very reduced.

" The sea-breeze from the N.W. usually began to blow about 9 a.m. and left off about 5 p.m., and then the land-

breeze from the S.E. would begin and last most of the night until about 7.30 a.m., when there was no breeze at all, so that this period of the day was extremely hot.

" In each case *P. cardui* was going against the wind-current. The butterflies flew very close to the ground, and they had a fairly high bluff (70 ft.) to get up before reaching the cultivated land which sloped gradually away from us to the Turkish lines. The period during which the observations were made lasted from about April 27 to about May 7."



Single arrow-head = direction of morning sea-breeze and of *Pyrameis cardui* against it.
Double arrow-head = direction of evening land-breeze and of *cardui* against it.
Zigzag line = bluff with Major Pendlebury's observation-post, shown by circle.
Thick line crossing bluff and observation-post = observed line of flight of *cardui*.
Dash-and-cross line = British trenches.
Dash-and-dot line = Turkish trenches.

Mr. C. B. Williams' record of the migration of *Calpodes ethlius* in Central America agrees with that of Major Pendlebury in the smaller numbers of the return flight in the evening (Proc. Ent. Soc., 1919, p. xxiii). It is possible that in both instances the streams were gradually dispersing over a favourable country, so that each day only a certain proportion of the crowd continued the migration.

It is, I think, in every way probable that the diurnal back-

ward and forward migration at Bukit Kutu as well as other similar instances on record are to be interpreted by the causes shown to have been in operation by Major Pendlebury.

Flight across the Wind in British Guiana.—Mr. C. B. Williams, in Trans. Ent. Soc., 1917, p. 154, records the direction of migration of *Callidryas eubule* in fourteen localities in British Guiana, the observations in some of these having been repeated over a number of years. The butterflies always flew directly or obliquely across the prevalent N.E. trade wind, sometimes from N.W. to S.E., sometimes *vice versa*. That a definite directive stimulus is at work seems to be clearly proved, not only by these concordant observations, but by Mr. Williams' account of a migration towards the S.E. which he observed in the North-west District, between Aug. 1 and 10, 1916. Throughout this period the direction of migration was resumed each morning after the night's rest, and after interruption on Aug. 5, by a whole day of heavy rain, and on Aug. 9 by heavy showers. Furthermore, during intervals of cloud, on Aug. 8 the numbers became so few—3 seen in four minutes—that each must have kept its direction without guidance by others. During the whole period the stream of migration proceeded, whenever it was resumed after the many interruptions, "in a south-easterly direction at a speed of about twelve miles per hour across the prevailing north-east trade wind."

Mr. Williams' records taken together strongly suggest that the direction of flight in *C. eubule* in British Guiana is due to reaction to the stimulus of the prevalent wind—a reaction such that the butterflies migrate backwards and forwards roughly parallel with the coast, and are not carried out to sea by flying against the wind or far into the interior by flying with it. Movement out of any area probably permits rapid recovery of the exhausted food-plant and the return of migrants from another exhausted area. Four of the migrations in the First Wet Season (May to mid-August)—Nos. 1, 7, 8, 12—crossed the wind-current from W. to E., one—No. 5—from E. to W. Four of the migrations in the Second Dry Season (end August to October)—Nos. 2, 3, 4, 6—crossed from E. to W., one—No. 13—from W. to E. These include

all the records with sufficient data, omitting No. 14 in the interior, where the seasons are different. Thus in the coastal zone the great majority of the wet-season migrations were down the coast, viz. towards the borders of Dutch Guiana, while an equal majority of the dry season were up the coast towards the Venezuelan border.

It would be of much interest to determine whether the migrants which reach any area are the descendants of those which formerly left it. The return migration, which took place about two months after the flight described by Mr. Williams (*ibid.*, p. 159), certainly suggests although it does not prove this conclusion.

While the observations on *C. eubule* were remarkably concordant and support the conclusion that this species has locally developed a favourable reaction to the prevalent wind, the single example of migration by *Appias margarita*, No. 16, apparently exhibits a reaction of the opposite kind, the stream of butterflies having been seen by Mr. A. Leechman for over three days flying obliquely against the wind, viz. in a direction which carried them out to sea (*ibid.*, p. 163).

The evidence, so far as it goes, suggests that the Pierine which migrates frequently exhibits a more favourable reaction to the local wind-current than the Pierine which migrates comparatively seldom.

This interpretation of the behaviour of *C. eubule* is not intended to imply that the direction of its migration is incapable of modification by other causes. Mr. Williams' map on p. 156 strongly suggests that the wide river Essequibo and the line of the coast may influence the direction, and, on p. 160, it is shown that the suddenly increased strength of the N.E. wind deflected a northerly flight towards the west.

Migration of Catopsilia statira in Trinidad.—Mr. C. B. Williams' interesting and detailed observations of a large migration of this species (Trans. Ent. Soc., 1919, p. 76) show that the general movement was westward, parallel with the N. coast of the island and the adjoining Venezuelan coast, viz. such as to carry the streams across to the mainland. And, in fact, Mr. Williams concludes with certainty "that the greater number left the island." The flight took place

Date.	Species.	Locality.	Direction of		Observer.	Reference and Remarks.
			Flight.	Wind.		
			ENGLAND.			
1874, June 4.	*Pieris brassicae, rapae.*	N. Lincolnshire.	N.E. to S.W. *Against.*	S.W.	Cordeaux.	Entom., vii. p. 161.
			INDIA.			
1881 ?	*Delias dione.*	Coast of India, ? E.	*Against.*	Head wind.	Biggs.	"Monthly Packet," ii, pp. 186–7.
1900, Aug. 12.	*Catopsilia crocale*, etc.	Kangra Valley.	W. to E. *Against.*	S.E.	J. Dudgeon.	Journal, Bombay Nat. Hist. Society, xiv. pp. 147–8.
1901, April 7.	*Belenois mesentina.*	Kangra Valley.	E. to W. *With.*	E. (light).	J. Dudgeon.	
1901, Aug. 27.	*Catopsilia pyranthe.*	Deesa, India.	S.E. to N.W. *Against.*	N.W.	C. G. Nurse.	Tom. cit., p. 179.
			CEYLON.			
1865, Dec. 3.	*Catopsilia, Pieris.*	Galle Face, Colombo.	S. to N. *Against, obliquely.*	N.E. Monsoon.	Holdsworth.	"Field," Dec. 28, 1872.

1865 Nov.	*Catopsilia*, etc.	Colombo.	S. to N. *Against, obliquely.*	N.E. Monsoon.	Holdsworth	"Field," June 29, 1872.
1865, April.	*Catopsilia catilla, C. crocale, Catophaga*, etc.	Colombo.	N. to S. *Against, obliquely.*	S.W. Monsoon.	P. E. Radley.	Entom., xxvi, p. 134.
1865, Nov., Dec., Feb.	(Pierines and Euploeines.)	Ceylon.	*Against.*	N.E. Monsoon.	Miss Gordon-Cumming.	"Two Happy Years in Ceylon."
1887, Nov. 18.	(Euploeines.)	Nuwara Eliya.	S.W. to N.E. *With.*	S.W.	Le Mesurier.	*l. c.*
1887, Nov. 21.	(Pierinae.)	Nuwara Eliya.	N. to S. *Obliquely, with.*	N.E.	Le Mesurier.	*l. c.*
1888, Nov. 18.	(Pierinae, etc.)	Colombo.	N. *Against.*	"In teeth of wind."	Unrecorded.	*l. c.*
1894, Nov.	*Catophaga galene.*	Colombo.	S. to N. *Against, obliquely.*	N.E. Monsoon.	Mitford.	"Zoologist," 1895, p. 388.
1895, March	*Catophaga galene.*	Ceylon.	N.E. to S.W. *Against.*	S.W. Monsoon.	Mann.	"Zoologist," 1895, p. 335.
1895, Oct. 25.	*Catopsilia* spp.	Colombo.	S. to N. *Against, obliquely.*	N.E. Monsoon.	N. E. Manders.	Trans. Ent. Soc., 1904, pp. 703–4.
1895, Dec. 2.	*Catopsilia* spp.	Trincomalee.	N. to S. *Obliquely with.*	N.E.	N. E. Manders.	
1895, April, May.	*Catopsilia* spp.	Ceylon.	N.E. "Generally" *with.*	S.W. Monsoon.	Sir E. Tennent.	"Natural History of Ceylon."

Date.	Species.	Locality.	Direction of		Observer.	Reference and Remarks.
			Flight.	Wind.		
1905, Nov. 21.	*Catopsilia* spp.	Ceylon (Colombo).	S. to N. *Against, obliquely.*	N.E. Monsoon.	Wickwar.	"Spolia Zeylanica," iii, pp. 216–18.
1907, Oct. 18–21.	*Catopsilia crocale*, *Papilio polytes*, etc.	Ceylon (E. province).	W. to E.	Not stated.	J. Daniel.	*l. c.*, v, pp. 106–7.
1908, Oct. 4.	*Euploea asela*, *Danais septentrionis*.	Ceylon (Trincomalee).	N. to S.	End of S.W. Monsoon. Variable.	A. Willey.	*l. c.*, v, pp. 186–8.
		BORNEO.				
1903, Jan. 12.	*Cirrochroa emalia*.	Kuching, Sarawak.	E. to W. *With.*	E.	R. Shelford.	Journ. R. Asiatic Soc. Str. Branch, 1903, pp. 203–4.
1915, Jan. 10 and 25.	*Cirrochroa emalia*.	Kuching, Sarawak.	E.S.E. to W.N.W. *Against, obliquely.*	N.N.W. (light).	J. C. Moulton.	Entom., xlviii, pp. 153–6.
		AUSTRALIA.				
No date.	*Belenois teutonia*.	Queensland.	E. to W.	Not stated.	Anderson.	"Victorian Butterflies," i, pp. 24–25, 29.
1903, Nov. 25–28.	*Belenois teutonia*.	Sydney, N.S. Wales.	N. to S. *Obliquely with.*	N.E. to N.W.	J. J. Walker.	Ent. Mo. Mag., xli, p. 229.

AFRICA.

No date.	*Catopsilia*? *florella*.	S.W. Africa.	"*With* the wind always."		C. J. Andersson.	Unrecorded.
No date.	*Catopsilia* sp.	Transvaal.	Not stated.		G. H. Kenrick.	Entom., xxxii, p. 288.
1869, March.	*Catopsilia florella* and *C. rhadia*.	Basutoland.	W. to E.	Not stated.	Col. Bowker.	Trimen, Trans. Ent. Soc., 1870, p. 383.
1886–7.	Species not mentioned.	Red Sea.	"*Against* stiff breeze."		H. S. Thomas.	Proc. Ent. Soc., 1906, pp. xviii, xix.
1901, Jan. 19.	*Pieris daplidice* (?).	Ingangane, S. Africa.	S.E. to N.W.	Not stated.	H. W. Bell-Marley.	Entom., xxxiv, p. 98.
1904, Feb. 10.	*Crenis boisduvali*.	Verulam, Natal.	S.W. to N.E.	Not stated.	H. W. Bell-Marley.	Entom., xxxvii, p. 116.
1911, 3 weeks from March 12; also in 1899.	*Catopsilia florella*, *Libythea laius*, etc.	Rabai, nr. Mombasa.	To E.N.E. *Against*.	E.N.E. (light).	Rev. K. St. Aubyn Rogers.	Proc. Ent. Soc., 1912, pp. xcvii–xcix.
1915, May 6.	*Libythea labdaca*.	Freetown, S. Leone.	To E.N.E. *Against, obliquely*.	N.E.	A. W. Bacot.	Proc. Ent. Soc., 1916, pp. iv, v.

NEARCTIC REGION.

1856, Nov. 15.	*Eugonia californica*.	San Francisco, U.S.A.	N.N.W. to S.S.E.	Not stated.	Dr. Behr.	Proc. Calif. Acad. Nat. Sci., iii, p. 124.
1870, Aug.	*Callidryas* sp.	Charleston, U.S.A.	N.E. to S.W.	"Light."	Gibber.	Canad. Entom., xii, p. 60.
1870.	*Callidryas* sp.	New Jersey, U.S.A.	N. to S.	Not stated.	Hamilton.	*l. c.*, xviii, p. 204.
1870.	*Callidryas eubule*.	Narraganset, U.S.A.	"From S."	Not stated.	Clark.	"Random Notes Nat. Hist.," i, p. 8.

Date.	Species.	Locality.	Direction of		Observer.	Reference and Remarks.
			Flight.	Wind.		
1874, Oct. 1.	*Terias lisa.*	Bermuda.	"From N.W."	Not stated.	Unrecorded.	"Psyche," 1875, p. 121.
1878, Sept.–Nov.	*Callidryas eubule.*	Macon, Georgia, U.S.A.	N.W. to S.E.	Not stated.	Willett.	Canad. Entom., xii, p. 408.
1879, March.	*Callidryas eubule.*	Macon, Georgia, U.S.A.	S.E. to N.W.	Not stated.	Willett.	
1888, May 14–15.	*Chlorippe celtis.*	Arkansas, U.S.A.	N. to S.	Not stated.	Webster, Holzgang.	"Insect Life," i, p. 21.
1890, Sept.	*Callidryas eubule.*	Alabama, U.S.A.	N.W. to S.E.	Not stated.	Davis.	"Insect Life," iii, pp. 335–6.
1894, April.	*Pieris monuste.*	Florida, U.S.A.	N. to S.	Not stated.	W. Hill.	Quoted by Scudder.
1895, Aug. (end).	*Hypatus (Libythea) bachmani.*	S. Marcos, Texas.	W. to E.	Not stated.	Knight.	"Insect Life," vii, p. 357.
		NEOTROPICAL REGION.				
1803, March.	(Pierinae.)	Brazil.	N.W. to S.E.	Not stated.	Lindley.	"Royal Milit. Chronicle," 1815, p. 452.
1807.	*Urania braziliensis.*	San Salvador (Bahia).	S.E. to N.W.	Not stated.	Verhuell.	Handl. der Nederl. Entom. Vereeniging, i, p. 75.
1817, June 12.	*Urania braziliensis.*	Pernambuco.	N. to S. *Against, obliquely.*	S.E. trade.	Swainson.	Zool. Illustr., 2, vol. iii.

1849, Nov.	*Callidryas*, 2 spp.	R. Amazon.	N.N.W. to S.S.E. *Across.*	Not stated.	Spence.	Journal Linn. Soc., Zool., ix, pp. 355–7.
1849.	*Callidryas* spp.	Obydos, Lower Amazon.	N. to S. *Across.*	E. during whole of summer.	H. W. Bates.	"Naturalist on Amazons," p. 131.
1854 ?, April.	*Urania leilus*, *Timetes chiron.*	Vera Cruz, Mexico.	"Northwards."	Not stated.	O. Friedreich.	Handl. der Ned. Ent. Vereen., 1854, p. 91.
1872, June.	*Timetes chiron*, *Urania leilus.*	Nicaragua.	N.W. to S.E.	Not stated.	T. Belt.	"Naturalist in Nicaragua," p. 151.
1872.	*Urania leilus.*	"Across Isthmus of Panama."	Not stated.		Unrecorded.	"American Naturalist," 1872.
1889, March.	*Urania boisduvali.*	Colon.	S. to N.	Not stated.	Davis.	"Insect Life," ii, p. 22.
1916, Aug. 1–10.	*Callidryas eubule.*	British Guiana.	From W.–N.W. to E.–S.E. *Across.*	N.E.	C. B. Williams.	Trans. Ent. Soc., 1917, pp. 154–64.
1916, Sept. 11–13.	*Callidryas eubule.*	Bartica, British Guiana.	N.W. to S.E. (General.) *Across.*	Light to N.E.	C. B. Williams.	
1917.	*Calpodes ethlius.*	Borders of Panama and Costa Rica.	To S.E. about 4.30 p.m., returning later in smaller numbers the same evening.	Not stated.	C. B. Williams.	Proc. Ent. Soc., 1919, p. xxiii.
1918, Sept.–Oct.	*Callidryas statira.*	Trinidad.	E. to W. (General.) *With.*	E. (prevalent).	C. B. Williams.	Trans. Ent. Soc., 1919, pp. 76–88.

Sept. 19–Oct. 12, 1918, after an unusually dry spell, in the middle of the wet season, and the speed was at the unusual rate of 17 miles an hour. In this migration Mr. Williams concludes that the wind, although contributory, cannot have been the conclusive factor in determining the direction of flight. His maps on Plates VI and X suggest that the mountain ranges and the southern coast-line exerted an important influence. The following interesting observation on Sept. 27 proves that migrating individuals are influenced by the flight of others, and also proves that this influence does not help us to understand how the line of migration is determined. Mr. Williams, in attempting to catch examples, noticed that "any butterfly narrowly missed was put off its direction by the excitement and flew off wildly in any direction. Other butterflies close at hand meeting this butterfly flying out of the general order would in turn become confused and sometimes follow it in its new direction. So that after several misses in succession I was surrounded by a number of butterflies flying in all directions. If I stopped attempting to catch specimens these would gradually pass away, and the regular direction of flight would be resumed" (p. 85).

Migration of Catopsilia pyranthe, C. crocale, and other Butterflies in Ceylon.—Col. N. Manders in Trans. Ent. Soc., 1904, p. 701, gave an account of butterfly migration in that island. The map on Pl. XXXV, together with his description, seems to prove that the wind cannot determine the direction, being with the stream on its southward course along the E. and S.E. coasts, but strongly against it on the W. when the butterflies have turned northward. In Ceylon the route clearly seems to be determined by a preference for the coast-line and for roads cleared through dense forest (p. 705). Migration, apparently in the same direction, occurs in February, in the dry season, and in November and December, in the wet. This peculiar sequence of migratory waves in the same direction is probably to be explained by the fact that females are laying their eggs all along the route. "Every female seemed possessed with the one insane idea of getting rid of her eggs with the utmost expedition . . . and then madly continuing her flight" (*ibid.*, p. 704).

The Proportions of the Sexes in Migration.—Many observations show that both sexes are present, but far more extensive data are required in order to establish the proportions. Inasmuch as the males commonly emerge earlier than the females, extensive collections should be made on each day of the whole period of migration. Col. Manders states that of 60 *C. pyranthe* of the February flight, 75 per cent. were males, while Mr. Wickwar agreed with him that the flight "in November and December were almost all females." Col. Manders thought that the predominance of males might be explained by the female larvae being starved by the scanty foliage of the drier months. His final conclusion was that "the migratory instinct, originally due to a necessity for the increase of the species, is now become a means of preventing its undue propagation" (p. 706).

Variation in Andrena rosae and A. trimmerana.—In the absence of the author Prof. Poulton read the following paper by Dr. R. C. L. Perkins, F.R.S., and exhibited a long series of specimens illustrating it :—

The *Andrena rosae* of Saunders' latest work included three species—two being seasonally dimorphic—for which the following names are here used.

1. *A. rosae* Panz. (summer brood).
   A. eximia Sm. (spring brood).
   = *teutonica* Alfk.
   = var. *spinigera, part.* E. Saund.
2. *A. trimmerana* Kirb. *nec* Auct. caet. (summer brood).
   = *rosae, part.* E. Saund.
   = *anglica* Alfk.
   A. spinigera Kirb. (spring brood).
3. *A. jacobi* Perk. (E.M.M., lvii, 1921, pp. 39, 40).
   = *trimmerana* Auct. *nec.* K.
   var. *scotica* Perk.
   var. *johnsoni* Perk. (E.M.M., l.c.).

A. jacobi, the well-known, common and almost ubiquitous, single-brooded species, universally known as *trimmerana* in the literature of over 100 years, does not vary much in the South of England, except when changed by the parasite, *Stylops*.

In Scotland locally and in Ireland there is a well-marked variety (var. *scotica*) the female of which, though larger, bears a considerable resemblance to *A. lapponica*, which sometimes occurs with it. In Ireland there is a still more aberrant form, which I have named var. *johnsoni*.

Very closely allied to this common species is the summer brood of the true *trimmerana* of Kirby, while its spring brood has a male differing greatly from these in structure.

That the true *rosae* either in its spring or summer form should ever have been confused with the other two species is remarkable, for, apart from important structures, its comparatively glabrous body gives it a most distinct superficial appearance.

Saunders was in error in saying of his *rosae* that the dark varieties were much more hairy than the red, for the black-bodied examples are just as bare as the reddest.

In the series of both broods of *rosae* and of *trimmerana* the variation is well shown. The specimens are mostly from Devonshire, where highly coloured varieties of *rosae* are frequent. It will be noticed that in this part of England the spring specimens are nearly all highly coloured—though one male is the blackest I have ever seen—while in the summer brood dark-bodied examples are frequent.

In *trimmerana*, on the contrary, the spring brood is on the whole darker in colour than the summer generation.

The seasonal dimorphism in the two species is always well-marked in the males, but in the females individuals of either brood occur which are practically alike, although the majority are easily distinguished.

An example of marked irregularity in the colour-adjustment of a Pieris rapae L., pupa to its surroundings.—Prof. Poulton exhibited, on behalf of Mr. A. H. Hamm, three pupae of *P. rapae* and one of *P. brassicae*, L., found within a few feet of one another on a wood fence which had been creosoted two or three times and was of a dark sepia colour. All the pupae were attached horizontally to the extreme top of the fence, immediately under a slightly projecting coping and therefore somewhat in shadow. The *brassicae* and one *rapae* were darkish pupae, the second *rapae*

was very dark, while the third was a bright green tint such as is usually produced on green, yellow or orange surfaces. The pupae were first observed at the beginning of November, 1920, and had been taken on December 5. The locality was Southfield Road, Oxford.

Aeschna grandis L., captured and eaten by sparrows. —Prof. Poulton exhibited three wings of this large dragonfly left by a sparrow which had eaten the body. The bird was seen by Mr. H. Hounslow to fly into the back garden of Wykeham House, Oxford, carrying the insect, which it proceeded to eat upon the lawn. Earlier on the same day, July 22, 1920, he saw a sparrow in the front garden catch and fly off with a similar dragonfly. Prof. Poulton had not previously come across any record of the capture by birds of these large and powerful insects.

Mr. G. T. Bethune-Baker brought for exhibition specimens of Lycaeninae from Provence (France) to show the large proportion of specimens of a more or less leaden-coloured blue taken in the summer of 1920. He said :—

"I have examined the scales under the microscope, and in all cases I find them ill-developed. They are unusually thin and fine in texture, and in all cases they are curled—in some a single roll, but in others a curling up from each side to meet in the centre; the curling is from the apex of the scales, not from the base.

"*Polyommatus icarus* from St. Martin Vésubie. Probably fifteen per cent. of the specimens I took were deficient in colour.

"*Polyommatus coridon*.—I took no defective ones at St. Martin, but at la Sainte Baume several were taken : three are shown, but I took more.

"*Polyommatus hylas*.—Out of a dozen specimens taken by me at St. Martin only one has any approach to normal colour, and that is by no means really normal.

"*Polyommatus escheri*. Many deficient in colour were taken at both places.

"*Polyommatus thetis* (*bellargus*).—Several of this species deficient in colour occurred at both Digne and at Mont Ventoux (Vaucluse); both of these show signs of streakiness.

"*Plebeius argus*.—Many of this species very deficient were taken by me at St. Martin Vésubie.

"*Lycaenopsis argiolus*.—I only took three specimens at la Sainte Baume and one female at St. Martin, and all of these are deficient.

"Now in what stage does this curious and interesting phenomenon take place? Something, I imagine, must occur at a critical time in the life of the larva. I am disposed to think towards the end of that stage, for it does not affect the size of the insects at all; it therefore cannot be malnutrition in the ordinary sense, and it seems to me that it is likely to be at some brief critical period after the last ecdysis and before pupation."

Mr. G. Talbot exhibited specimens of *Euploea* from the Joicey Collection illustrating a black-and-white spotted mimetic combination in the Tenimber Islands, Fiji, and Australia, and a white-banded group in the Key and Aru Islands.

Tenimber Is.—*Euploea visenda* Butl., *compta* Rober, *elutho sacerdos* Butl., and *Hypolimnas alimena forbesi* Butl., ♀.

Fiji Is.—*Euploea proserpina* Butl., *helcita eschscholtzi* Butl., and the form *intermedia* Moore.

Australia.—*Euploea elutho corinna* McLeay, *pelor* Doubl. & Hew., *tulliolus darchia* McLeay, *eichorni* Stgr., *sylvester* Fbr., *niveata* Butl.

Cook Is.—Forms of *Euploea helcita*, represented by *indistincta* Moore, and *unicolor* Druce.

Tahiti.—*E. helcita walkeri* Druce.

Key Is.—*Euploea climena curypon* Hew., *hopfferi* Feld., *assimilata* Feld., *sacerdos* Butl., *Hypolimnas deois hewitsoni* Wall. ♀, *alimena heteromorpha* Rob. ♀.

Aru Is.—*Euploea climena vicina* Feld., *confusa grayi* Feld., a new ♀ form closely resembling *vicina*, *Elymnias agondas aruna* Fruh.

Rossel Is.—*E. eurianassa* Hew.

New Hebrides.—*E. tristis* Butl., *E. helcita* form.

Tonga.—*E. helcita* form.

N. Caledonia.—*E. helcita helcita* Bdv.

Christmas Is.—*E. climena macleari* Butl., shown as being

identical with *malindeva* Waterh. and Lyell, from N.W. Australia.

In the discussion which followed Mr. P. A. Buxton raised the question how far this was a question of mimicry at all.

Prof. Poulton said that he believed the superficial resemblances exhibited by Mr. Talbot to be mimetic because they followed the rules of mimetic resemblance elsewhere. For example in Africa members of specially protected groups resembled each other and often resembled those of other groups, while both were resembled by species of groups not known to be specially protected; when the resemblance differed in the two sexes the females bore the stronger likeness and were often mimetic while the males were non-mimetic. Conspicuous among the mimics of Danaines and Euploeas in the Old World tropics were females of the Nymphaline genus *Hypolimnas* with non-mimetic males.

The island groups exhibited by Mr. Talbot followed the above rules; they showed strong resemblance between members of the specially protected group of Euploeas, and mimicry of them by the females but not the males of the species of *Hypolimnas* in the same island. Just as the patterns of representative groups differed in different parts of Africa so they differed in passing from one island to another—the differences running through all the members of each local group and being thus independent of affinity. Prof. Poulton had furthermore shown that in Fiji the resemblance of the female *Deragena proserpina* Butl., to *Nipara eleutho* Quoy. was carried further than in its male and that these common Euploeas were resembled by the less common Danaine *Tirumala neptunia* Feld. (Proc. Ent. Soc. Lond., 1919, p. lxix). Here too the resemblance was especially strong in the females. Finally the prevalence of dyslegnic patterns was as characteristic of these island mimics as of the better known examples from continental areas.

Margarodes unionalis in Britain.—Mr. Robert Adkin exhibited a specimen of *Margarodes unionalis* that was taken at sugar at Arlington, a village about seven miles inland from Eastbourne, on October 3, 1920. The species appears to have been first recorded in this country by Stainton in

1859 from a specimen taken by a Mr. George King at Torquay earlier in that year. Further specimens have been taken from time to time, usually at intervals of several years, as a rule near the south coast and generally, as in the present case, when two others were taken in South Devon, at more than one place. The species is a native of Southern Europe, and it is evident that the individuals that we occasionally meet with in this country are migrants, and their distribution appears to show that when migration takes place it is widespread.

Mr. H. St. J. Donisthorpe exhibited several strings of "ground pearls," *Margarodes*, probably *M. formicarum* Guilding, which a neighbour (Mrs. Dawson) had had sent to her from Jamaica, and was informed they were "ants' eggs." He remarked that the Rev. Guilding had described the species from the West Indies in 1829, associated with ants; and that Mr. Trimen had also taken a species of *Margarodes* in ant's and termite's nest in Cape Colony.

He also exhibited two specimens of a species of *Cionus* new to science which had been swept near Lake Windermere by the Rev. Canon Theodore Wood a few years ago.

Major W. J. Pendlebury brought for exhibition :—

(1) A dark form of the Carabid beetle, *Anchomenus dorsalis*, taken in Brecon. Mr. Blair stated he could not recollect having seen so dark a form. No varieties are named by Fowler or Reitter.

(2) A variety of the mosquito, *Theobaldia annulata*, not previously recorded in Britain. First found in Mesopotamia by Capt. P. J. Barraud, and recorded by him in the "Bulletin of Entomological Research" in 1920 as a variety of *T. annulata*. Since received in the South Kensington Museum from Palestine, Macedonia and Denmark.

The almost uniform ochreous colour at first suggested a desert variety, especially as it was the only form found in Mesopotamia, but in Palestine, Macedonia and Denmark it appears with the typical form. The colour difference is very sharply defined, and no intermediates have yet been recorded. There is no structural difference between the two forms either in the adult or larval states.

The present specimen was taken at Earl's Court on October 27, 1920, by the exhibitor. The variety has been given the manuscript name of *subochrea* by Mr. F. W. Edwards, to whom the exhibitor is indebted for the identification and details.

Mr. Hy. J. Turner exhibited a specimen of *Zygaena* sent to him by Mr. Greer of Tyrone as a natural hybrid between *Z. lonicerae* and *Z. filipendulae*, taken on ground where the two species appear at the same time, and have occasionally been observed to copulate. A short series of the two species from the same locality were shown for comparison. The general coloration, shape of wing, margin of hind-wing, and underside coloration and marking tended towards *lonicerae*, while there were six spots, the sixth being decidedly feeble; the antennae were more like those of *filipendulae* and the size and shape of the spots were those of *filipendulae*. He also showed a sample illustrative of the large and very abundant colony of *Z. filipendulae* on the S.E. of Box Hill, in which the sixth spot was almost invariably very weak and the first to disappear from wear, together with a specimen of *Zygaena anceps* recently described by M. Oberthür from Hyères, and a short series of the Hyères race *olbiana* of *Z. trifolii*, which has also been named by M. Oberthür.

Mr. W. G. Sheldon exhibited a series of 243 bred specimens (1920) of *Peronea hastiana* L.: from Sutherlandshire, 126; Wicken Fen, 63; Isle of Wight, 26; and Lancashire Coast, 28. These specimens were the whole of those bred in 1920, with the exception that of the Lancashire specimens about fifty more than those exhibited were bred; these were entirely a melanic form. The series includes most of the named forms and a number of unnamed ones.

Dr. Jordan exhibited *Musurgina laeta*, a new genus and species of Agaristidae from Madagascar, remarkable for its very strongly clavate antenna and the development of a stridulating organ. The fore-wing of the species, of which only the ♂ is known, is russet brown and bears a white stripe which runs from the base to the lower cell-angle and thence parallel with the termen to the costal margin, the hind-wing being orange, with a black terminal band. The stridulating

organ consists of a transversely ribbed naked area on the underside of the fore-wing occupying the cell and extending to the submedian fold. The median vein bears a row of numerous transverse ridges, a corresponding "file" being found on the upperside of the hind tarsus. Stridulating organs of this or a similar type are known to occur in a number of species of Agaristidae and Noctuidae. In *Musurgina* the fore-wing has acquired an additional structure not observed elsewhere. The submedian fold which bounds the stridulation area posteriorly is replaced by a prominent, strongly chitinised, ridge, which might easily be mistaken for a true tubular vein. As the ridge does not extend distinct beyond the stridulation area, it is evident that the ridge has arisen in connection with and on account of the stridulating organ, as a support of the wing membrane. This stiffening might have been more economically effected by a tubular vein instead of a practically solid ridge. Evolution, however, is evidently unable to reconstruct the lost submedian tubular vein, although the trachea on which this vein is built up in generalised Lepidoptera (such as Zygaenidae, Cossidae, etc.) is still present in the chrysalids of the specialised families which have lost that vein.

Musurgina recalls *Pemphigostola* Strand (1909), which is placed by the author with the Castniidae. On re-examination *Pemphigostola* will probably turn out also to be an Agaristid.

Papers.

The following papers were read:

"Notes on the Rhopalocera of the Dollman Collection," by N. D. Riley.

"The Male Genitalia of *Merope tuber* Newman (Mecoptera)," by Frederick Muir.

Wednesday, March 16th, 1921.

The Rt. Hon. Lord Rothschild, M.A., D.Sc., F.R.S., etc., President, in the Chair.

Resignation and Election of Hon. Secretary. Vote of Thanks.

The President announced that, owing to ill health, the Rev. G. Wheeler, M.A., F.Z.S., had been compelled to resign the Secretaryship. A unanimous vote of condolence and a vote of thanks to him for his services were passed, on the motion of the President, seconded by the Treasurer.

The President announced that Mr. H. Rowland-Brown, M.A., had been elected Hon. Secretary in place of Rev. G. Wheeler.

Election of Fellows.

The following were elected Fellows of the Society:—Capt. K. J. Hayward, Aswân, Egypt; Mr. E. Bolton King, Balliol College, Oxford; Mr. L. M. Pears, West Virginia, U.S.A.; Mr. E. D. Lewis, Swanley, Kent; Mr. W. J. Hall, Cairo, Egypt; Mr. D. Pouniah, Federated Malay States; Mr. H. Donald Hope, Jermyn St., London, S.W.; Prof. S. Matsumura, Japan; and Prof. C. P. Alexander, Illinois, U.S.A.

Gifts to the Society's Rooms.

The President announced that gifts for the decoration and embellishment of the Society's New Rooms would be much appreciated.

Informal Meetings.

The President announced that for the present Informal Meetings, to which Fellows and their friends were invited, would be held in the Society's Rooms from 5–10 p.m. on the third Wednesday in all the months when there was one meeting only advertised for the month.

Debates and Discussions.

Fellows were requested to suggest subjects of entomological interest for debate and discussion, and their attention called to the Discussion Book, now replaced in the Library.

Exhibitions.

The mimetic relationship between Heliconius notabilis microclea Kaye, and H. xenoclea xenoclea Hew. —Prof. Poulton said that the interesting fact that species or subspecies of *Heliconius* belonging to Section I, the Opisogymni, mimicked species of the same genus in the same localities belonging to Section II, the Opisorhypari, had been demonstrated to the Society by Mr. W. J. Kaye (Proc. Ent. Soc. Lond., 1907, p. xiv) and more recently worked out in detail in Dr. H. Eltringham's monograph (Trans. Ent. Soc. Lond., 1916, p. 101); and it had furthermore been shown that species of Opisogymni, which do not mimic the Opisorhypari, closely resemble Ithomiine models. To this rule that the Opisogymni behave as mimics an exception was believed to be found in *xenoclea*, the supposed model for *microclea* (Opisorhypari). This view of the relationship was accepted by Mr. Kaye and Dr. Eltringham * in the papers quoted above, and it was based on the relative numbers of the two species to be found in collections. But relative numbers, although usually a trustworthy guide, did not always settle this question. The relative abundance of a species was determined by a variety of causes outside those which are believed to promote the evolution of mimetic resemblance —viz. the discriminating attacks of vertebrate enemies, especially birds. A mimic may be less attacked and less parasitised by invertebrate enemies than its model, may be more fertile, may have a more dominant food-plant. From causes such as these the predominance of certain mimics might probably be explained—of *Hypolimnas misippus*, *bolina*, and *dubia*, and of *Papilio polytes*—all very common species, known at certain times and places to outnumber their models. In all these examples, however, there is no difficulty in deciding that they are mimics and not models because, even if they are to some extent specially protected by taste or smell, the species they resemble are known to be highly distasteful and

* On pages 112 and 117 Dr. Eltringham speaks of *microclea* as resembling *xenoclea*, but in his Plate XII, *microclea* (fig. 3) is represented, correctly in my opinion, as the model of *xenoclea* (fig. 4).

to belong to groups which are widely mimicked. Furthermore, in all but *H. dubia* the non-mimetic males preserve the ancestral patterns of the females.

In *Heliconius microclea* and *H. xenoclea* the difficulty is much greater. Their sexes are alike in pattern while they both belong to the distasteful, mimicked genus *Heliconius*. Assuming that they are equally distasteful, and that, on the Müllerian principle, it would be an advantage to them both to possess a similar warning pattern, then, other things being equal, the approach will be from the pattern of the less numerous to that of the more numerous. But other things may be unequal; one species may be constant and the other variable, and this difference may cause a more abundant *Heliconius* to mimic a less abundant one. Of the two species, *xenoclea* is the more variable and its pattern possesses the dyslegnic border which lends itself to variability and is commonly characteristic of mimics as compared with their models. The description of both species as eulegnic in Proc. Linn. Soc. Lond., 1915–16, p. 52, was based on insufficient material, although here it was recognised that the inner marginal edge of the central fore-wing patch in *xenoclea* was less eulegnic than other parts of the border. Since the publication of this paper an interesting collection made in W. Central Peru by Mr. G. H. Bullock, of H.M. Consular Service at Lima, has thrown further light on the subject. The following series of the two Heliconines was taken by Mr. Bullock near the junction of the Chanchamayo River with the Perené River, at a height of about 3000 ft., the season being intermediate between wet and dry.

Captured in 1918.	*Heliconius notabilis microclea.*	*Heliconius xenoclea xenoclea*
May 22 . .	2	2
,, 23 . .	2	1
,, 24 . .	1	1
,, 25 . .	1	2
,, 26 . .	1	1

There can be no doubt that the butterflies would be indistinguishable upon the wing and that they were taken as a single species; and the table shows that they fly together daily in the same locality. Furthermore, when the seven specimens of each species are ranged side by side the greater variability and the soft dyslegnic border of the whole pattern of *xenoclea* is in evident contrast with the constancy and the hard eulegnic edges of *microclea*. Finally, whatever may have been the experience of others, Mr. Bullock's collection supplies evidence that in this locality, in May 1918, the two species were flying together in approximately equal numbers.

Apparently discriminative attacks by beetle larvae upon papered butterflies of protected groups.—Prof. Poulton said that there was some evidence of discriminative attack upon Mr. Bullock's collection from W. Central Peru. Of four small butterflies in a single "paper"—2 Satyrines, 1 Ithomiine, and 1 Nymphaline (*Eresia* or *Phyciodes*)—only wing-fragments remained. Omitting these from consideration the following two groups were especially attacked:—

Danainae.—5 ♂, 3 ♀ of *D. plexippus* L., were attacked, 5 ♂, 1 ♀ uninjured.

Heliconinae.—*H. telesiphe* Dbl.—1 attacked; *H. sara thamar* Hübn.—1 out of 3; *H. doris* L. (blue form)—1 out of 18; *H. xenoclea* Hew.—3 out of 7; *H. microclea* Kaye—1 out of 7.

In marked contrast were the groups in which attacks were almost wanting: the Nymphalinae—2 (*Ageronia* and *Anaea*) out of 105 individuals; and the Pierinae—1 (*Terias*) out of 27. The Papilioninae were only represented by 4 *Aristolochia* Swallowtails and of these 1 was attacked.

The following groups were not attacked at all (except for the specimens in the single paper mentioned above):—Ithomiinae (30 individuals); Satyrinae (31); Morphinae (14); Acraeinae (1); Lycaenidae (1); Erycinidae (9); Hesperidae (4); Moths (9).

These facts, so far as they go, agreed with Bates' observation recorded in his classical paper (Trans. Linn. Soc. Lond., vol. xxiii, 1862, p. 510): "I have noticed also that recently

killed specimens of Danaoid Heliconidae [Ithomiinae], when set out to dry, were always less subject than other insects to be devoured by vermin." But apart from the Ithomiinae, Mr. Bullock's collection made it probable that certain Coleopterous larvae had a preference for two other distasteful groups, the Danainae and Heliconinae. There is nothing to excite surprise in the evidence that certain, probably exceptional, pests should specialise in the dried bodies of butterflies generally protected by distasteful qualities, any more than in the undoubted fact that certain exceptional enemies prey upon them when alive.

A new Palaearctic species of the Lycaeninae, and other Lepidoptera from Mesopotamia.—Lt.-Col. H. D. Peile, I.M.S., exhibited—

(1) *Polyommatus peilei* B.-Bak. *Habitat:* Karind Gorge (N.W. Persia), 6,000 ft. July (*H. D. Peile*). Type in the British Museum, described from six ♂♂ and one ♀. (The Karind Gorge is just over the Persian frontier.)

Mr. Bethune-Baker remarks:

"It is, I think, the most extraordinary Palaearctic species of the true Lycaeninae that I know; its colour separates it from everything, but the underside pattern shows it to be a near ally of that beautiful species that Staudinger called *dama*, with which indeed it was flying when Lt.-Colonel Peile captured it. The androconial scales also connect it closely with the *dolus* group."

L. dama karinda Riley, and *L. damone damalis* Riley, taken in company with the new form, were exhibited for comparison.

(2) *Zegris eupheme dyala*, Peile (Entom. LIV, p. 151, 1921), 6 ♂♂, 3 ♀♀ exhibited. This form differs from subsp. *menestho* Menetries, which occurs at Fathah on the right bank of the Tigris in Mesopotamia (and in Asia Minor and W. Kurdistan), in the absence of the yellow suffusion in the ground-colour of the hind-wing, and in the darker shade of the grey outer portion of the apex of the fore-wing above; and from subsp. *tschudica*, Herrich Schaffer described as an aberration, which it most approaches, many examples from Mesopotamia being "drier" still than this, having more white in proportion to the green;

also the green is more tinted with yellow or sienna, especially in the later emerged examples. These green prolongations vary much in width and in the amount of yellow or sienna in them.

♀ slightly the larger as a rule: the orange patch at apex of fore-wing usually smaller, in a few examples yellowish, and in a few others altogether absent. Otherwise this form varies but little.

Locality: Left bank of the Dyala from 350 to 600 ft., in March and early April. Females seen ovipositing on young flower-buds of a mustard and a mauve flowered Crucifer.

Z. cupheme tigris Riley. ♂♂ 4, ♀♀ 2, from the right bank of the Tigris, taken March–April 1920, also exhibited for comparison.

(3) *Melitaea trivia*, subsp. *persea* Koll. A small series of each of three seasonal forms:—

(*a*) *Spring form*, from Mesopotamia and N.W.F., India, March and April; comparatively large and with black spots well-marked above and on underside, two females being especially large examples.

(*b*) *Summer form*, from Mesopotamia, June–July; averaging smaller, and with much less black above and beneath.

(*c*) *Autumn form*, from N.W.F., India, Sept.–Oct.; very similar to the Spring form.

The Subfamilies of Formicidae.

Mr. H. Donisthorpe read the following communication:—

In all the recent works and catalogues on ants up to 1920, five subfamilies have been recognised—namely, Ponerinae, Dorylinae, Myrmicinae, Dolichoderinae, and Camponotinae, and this arrangement is the same as that used by Dalla Torre in 1890.

In 1920 Wheeler, after studying a great number of ant larvae of many genera and subgenera in all five subfamilies, proposed to raise two more subfamilies—the Pseudomyrminae, and the Cerapachyinae.

Let us see how far Wheeler is justified in this proceeding.

Pseudomyrminae.

In 1899 Emery had already proposed this additional subfamily, which he separated on account of the large heads and rudimentary antennae of the larvae, etc. [various other ant larvae, Ponerine, etc., possess short rudimentary antennae; I even found them, though in a still more rudimentary con-

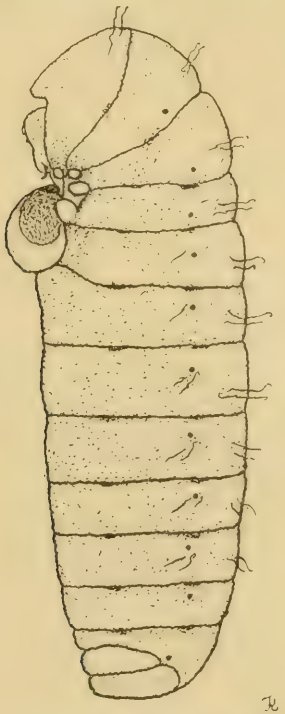


Fig. 1.—Lateral view of larva of *Pseudomyrma gracilis* Fabr.

dition, in the genus *Myrmica*, as figured in "British Ants" (page 31)], but he subsequently withdrew this subfamily, and replaced the genera in the Myrmicinae. Wheeler has shown that in all the four genera—*Tetraponera* (=*Sima*), *Pseudomyrma*, *Pachysima*, and *Viticicola*, which are embraced by the Pseudomyrminae—the larval characters are most important. They all possess long, straight, cylindrical, distinctly

segmented bodies, with blunt anterior and posterior ends, a large head ventrally placed, and short, rudimentary antennae. The thoracic and first abdominal segments are furnished with peculiar exudatory papillae, which form a cluster around the mouth. They have the form of extraordinary appendages, which in the first larval stage, Wheeler has called the trophidium; and the swollen ventral portion of the first abdominal segment just behind the mouth forms a pocket,

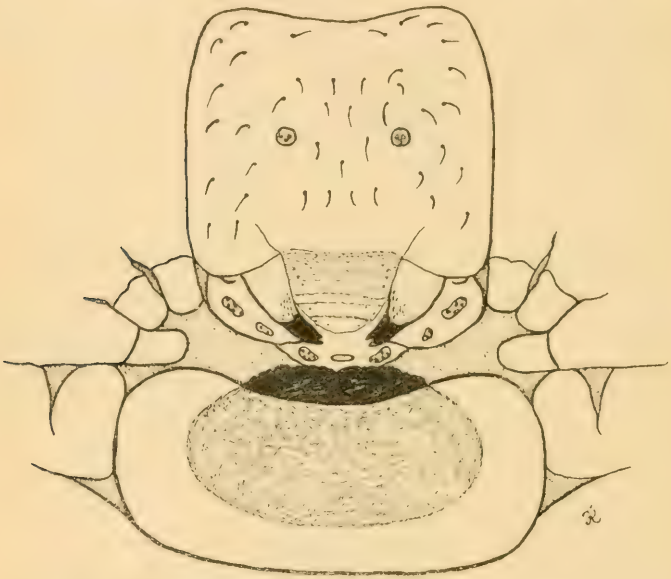


FIG. 2.—Head, trophothylax and exudatoria of larva of *Pseudomyrma gracilis* Fabr.

the trophothylax, in which the workers place the pellet from their own infra-buccal chamber.

We have described this pellet and chamber in "British Ants" as follows: "The infra-buccal chamber is a spherical cavity situated below the pharynx, and forms a receptacle for the solid and semi-solid parts of the food rasped off by the ant's tongue and also for foreign matter scraped off the ant's body by its tongue and strigils. Any juices that remain in these substances are extracted and sucked into the pharynx,

the residue being ejected in the form of a solid body, the 'Boulettes de nettoyage' of Janet, which retains the shape of the infra-buccal chamber."

After the pellet has been ejected it must still contain a considerable amount of nutritious matter, for, as I have shown, it forms the chief, if not the only food of the larva of the Dipterous genus *Microdon*, and also forms part of that of the beetle larva of *Clythra 4-punctata*. But to return to the Pseudomyrminae, all four genera feed their larvae in

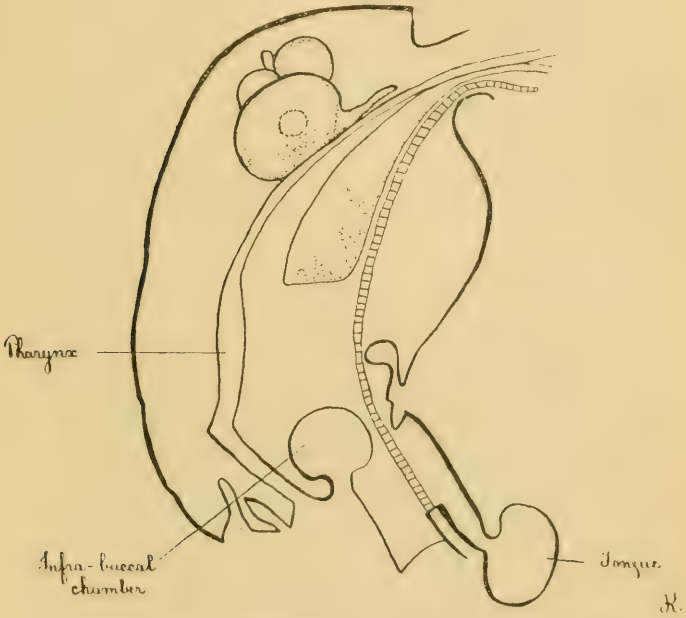


Fig. 3.—Head of *Myrmica* from "British Ants," p. 16.

this way; and no other ants have been observed to do so, but eventually spit them out. The mouth of the larva possesses a singular structure, the trophorhinium, with which they thoroughly grind up the pellet. This structure is also present in other ant larvae, and may be used as a stridulating organ.

In the adults the shape of the head in the ♀ and ☿, especially of the clypeus and frontal carinae, is unique; and the eyes

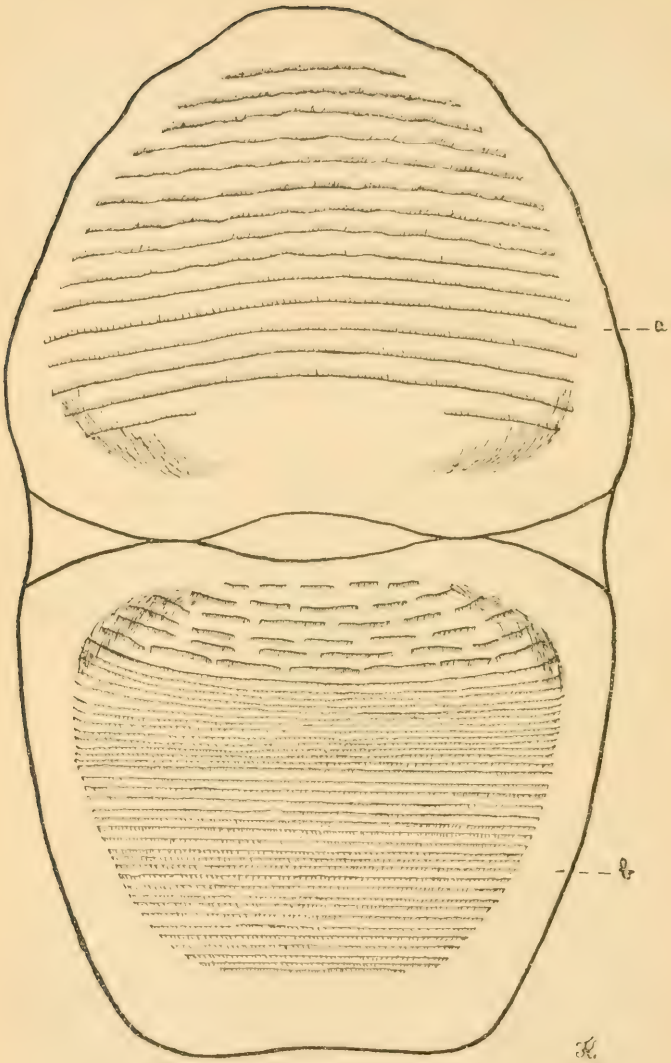


FIG. 4.—*Trophorhinium.*
a, roof. *b*, floor of mouth.

are very large. The construction of the petiole, post-petiole, and tibial spurs is peculiar. Wheeler has recently shown the antennae are 12-jointed in the ♂, ♀ and ☿ of all four genera, and he has also proved that the gizzard is much more specialised than in other Myrmicine ants.

I do not know what my colleague Mr. Crawley's views are on the subject, nor have I yet seen any opinions expressed by any other of the first myrmecologists, but personally I consider that all the above points taken together justify Wheeler in raising these four genera to the rank of an independent subfamily.

Cerapachyinae.

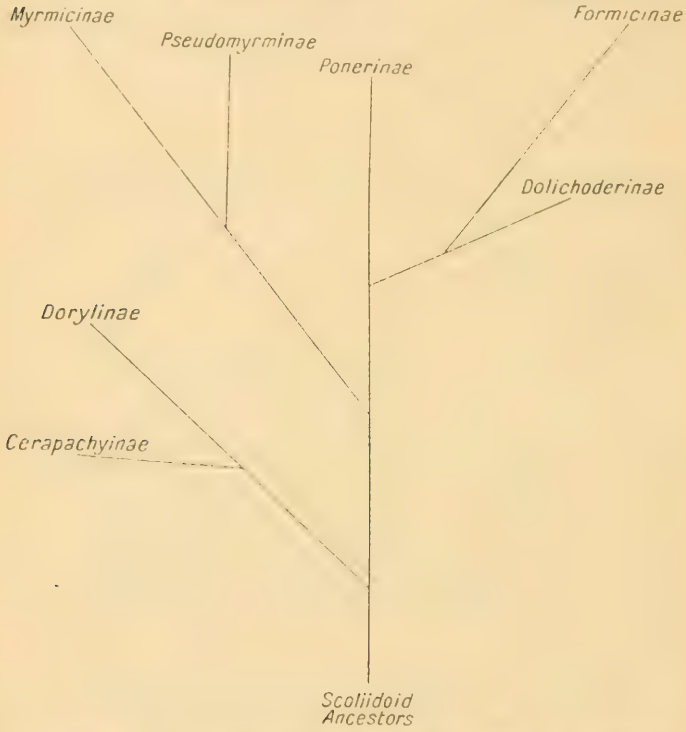
In 1895 Emery transferred the tribe Cerapachyini from the Ponerinae to the Dorylinae, a proceeding with which both Forel and Wheeler disagreed. He subsequently returned them to the Ponerinae with the rank of a section which he called Prodorylinae.

The larvae are extremely like those of the Dorylinae, and the foraging habits of certain of the adults are similar. The worker, on the other hand, has a Ponerine habitus, but the female characters in the various genera are very diverse, some being very Ponerine-like, others being so like a Doryline ♀ that they might be taken for a dichthadiigyne. The same is the case in the males—a male of the genus *Acanthostictus*, which has been recently discovered in the Argentine by Gallardo, might easily be mistaken for a male *Dorylus*. Other males are very Ponerine like, though they do not possess penicilli.

It will thus be seen that these ants are intermediate between the Ponerinae and the Dorylinae and might easily be united to either. Wheeler therefore prefers to treat them as a subfamily; and this certainly has its advantages. Emery's name Prodorylinae, which otherwise might become the name of the subfamily, cannot be used, as there is no genus named *Prodorylus*.

We reproduce the diagram in which Wheeler indicates the phylogenetic relations of the seven subfamilies. It will be seen that he uses the name Formicinae for the subfamily

usually called Camponotinae. Forel (1878) divided Mayr's subfamily Formicidae (1855) into Dolichoderinae and Camponotinae, and he justified this because Formicidae was already in use as a family name. According to our present rules, and the use of "inae" as a suffix for subfamily names, he should have retained Mayr's name, and restricted it to the group containing *Formica*. I am indebted to Miss Kirk for



the beautiful reproductions of the figures used to illustrate this short paper.

Mr. E. B. Ashby, F.E.S., exhibited an example of *Papilio machaon*, ♀, ab. *rufopunctata* Wheeler, captured on Les Voirons, a range of mountains near Annemasse, Haute Savoie, July 6, 1920. Distinguishing characteristics of this aberration of *P. machaon* are the orange-red spots in yellow lunules of border upper side hind-wings near the costa.

Parasemia plantaginis L., 5 ♂♂ and 1 ♀, all taken just below the top of the Col de la Faucille, above Gex in the French Jura, on July 1, 1920. At 3.30 p.m. this moth was flying there in extraordinary abundance. The specimens exhibited show *great diversity of variation*. The exhibitor included a specimen of the same moth taken at the Col Ferrett on the Italian side of Mont Blanc, not far from Courmayeur, on July 22, 1911, also remarkable from the hind-wings being almost entirely covered with the blackish suffusion, much more so than in any of the specimens brought by him from the French Jura. This specimen may be referred to the variety *matronalis* Friv., figured in Kirby.

The PRESIDENT remarked that the example presented as *matronalis* was hardly black enough to be referred with certainty to that aberration.

Papers.

The following papers were read :—

" On Some Chrysomelidae (Coleoptera) in the British Museum," by ARTHUR M. LEA.

" Types of Heteromera described by G. F. Walker now in the British Museum," by KENNETH G. BLAIR.

Wednesday, April 6th, 1921.

The Rt. Hon. Lord ROTHSCHILD, M.A., D.Sc., F.R.S., etc., President, in the Chair.

Election of Fellows.

The following were elected Fellows of the Society :—

Miss J. RIDDELL, of the Y.M.C.A., 250, S. Hill St., Los Angeles, U.S.A.; Mr. C. DOVER, The Indian Museum, Calcutta, India; Mr. D. J. ATKINSON, of Broadoak House, Newnham, Gloucestershire; Mr. L. B. HOPPER, Manor House, Penryn, Cornwall; Mr. F. H. LANCUM, Fernside, Shepherds Lane, Dartford; Mr. F. D. COOTE, 11, Pendle Road, Streatham, S.W.; Mr. H. E. BOX, 151, Stamford

Hill, N. 16; Mr. H. M. Simms, B.Sc., The Farlands, Stourbridge; Mr. H. H. Wallis, M.A., 145, Wilmer Road, Heaton Road, Bradford; Mr. F. Rhodes, 113, Park Row, Heaton Road, Bradford; and the Rev. G. Watkinson, M.A., Woodfield, Hipperholme, nr. Halifax.

Exhibitions.

Remarking on early emergences this season, Mr. E. E. Green said that—

"An unusually early appearance, this year, was a freshly emerged specimen of *Xanthorrhoë fluctuata*, which came in to light on the 12th March.

"With regard to the debated question of the hibernation of *Pyrameis atalanta*, it may be of interest to note that a very worn specimen was observed by me here (at Camberley), feeding at sallow blossom, on the 17th March."

Insects of Tropical America.—Mr. C. B. Williams exhibited (1) a Lamellicorn beetle from Trinidad, B.W.I., and a photograph of a dining-table during the swarming of this species in the wet season. Two or three hundred beetles had been attracted by the light above the table.

(2) Specimens of the Cercopid, *Tomaspis saccharina*, very injurious to sugar-cane in Trinidad, B.W.I. This insect is dependent on soil condition to a remarkable degree, and its regular prevalence in any area is an indication of a heavy clay soil. The chief injury done by the insect is to the leaves of the cane, and a discoloured streak is formed from each puncture of the insect, which continues to increase in size for several weeks after the puncture is made.

(3) A burrowing wasp, *Monedula* sp., which collects and stores up bloodsucking flies (Tabanidae) in British Guiana.

Commenting on this exhibit Mr. Williams drew attention to a habit of most of the burrowing wasps and mud-wasps in Trinidad and British Guiana. This is a shrill buzzing during the act of digging or of spreading mud. The only plausible explanation of this habit, which draws attention to the nests, seems to be that the jaws of the insect work rapidly in a series of small pressures instead of a steady

push, thus resembling the method used in some modern machines, as, for example, the hydraulic rivetter. The noise then becomes a necessary result of the vibration, and is unavoidable.

Lepidoptera from N.W. Persia.—Lt.-Col. H. D. Peile, I.M.S., exhibited, and read notes on the following butterflies :—

" (1) Two pairs of *Papilio machaon*, subsp. *centralis* Staud., from Mesopotamia; one pair captured, the other pair from over forty reared from larvae found and fed upon flowers of rue (*Ruta tuberculata* L.). Pupa-cases also shown.

" (2) *Colias glicia* Fru., gynandromorph, left side white, right yellow; taken on 10th April, 1914, at Bannu, N.W.F., India, at a flower of *Oxalis cernua* Thnb.

" (3) *Anthocharis transcaspica* Stgr., one ♂ example taken at Fathah, Mesopotamia. This specimen agrees with one in the Brit. Mus. Coll. labelled ' East of the Caspian.'

" A series of *Anthocharis lucilla* Bdv., for comparison with the last, taken in the Tochi valley, N.W.F., India.

" (5) *Zephyrus quercus longicauda* Riley, a series from about fifty taken in the Karind valley, N.W. Persia. This form is larger than the *quercus* type, has well-developed, filamentous tails, and is in the males of a bright magenta shade, the females also being brightly coloured.

" (6) *Satyrus parisatis* Koll., a pair from some taken at Paitak, N.W. Persia, and a male aberration lacking the white bands on the under-side. This is perhaps the most Western record for this species."

Xylocopa violacea in Herts.—Dr. J. Waterston exhibited, on behalf of Mr. Harold A. Geldard, Hillside, Lauderdale Road, Hunton Bridge, King's Langley, a female example of the carpenter bee (*Xylocopa violacea* L.) together with larva, pollen mass, cells and post in which the bee had burrowed.

All this material was taken at Hunton Bridge in the summer of last year (1920), when the bee was seen at work, and frequented the post exhibited for four weeks, at least, before it was finally captured.

The bee has been presented to the National Collection.

Hymenopterous Parasite on ? Pachylia syces.—Dr. J. Waterston also exhibited several large snow-white cocoon masses of a Braconid from Jamaica, and made the following remarks :—

"These masses are the work of *Apanteles americanus* Lep., a species until lately not represented in the Brit. Mus. Coll., but within a week recently received first from the Imperial Bureau of Entomology (sent for determination by Sir Francis Watts, K.C.M.G.) and again from Mrs. H. Fife, 41, Linden Gardens, W. 2, who left several masses at the Museum with the note that they occurred frequently 'on Cassava.'

"With the *Apanteles* there were in both consignments numerous examples of *Horismenus nigroaeneus* Ashm., which is apparently a hyperparasite through the Braconid.

"The host of the *Apanteles* was not ascertained by either collector, but it is almost certainly one of the Sphingidae, most probably in Lord Rothschild's opinion *Pachylia syces*, subsp. *insularis*.

"Similar large cocoon masses are made in Ceylon by *Apanteles acherontiae* Cam., which parasitises *Acherontia lachesis* feeding on leaves of the 'dadap' tree (*Erythrina lithosperma*). Cameron notes that *A. acherontiae* also suffers from the attacks of hyperparasites (*Hemiteles* (Ichn.) and a Chalcid genus), but gives no specific determination of these. (See Cameron, P., Spolia Zeylanica, vol. 5, p. 17, and Green, E. E., *ibid.* p. 19, with plate, 1908.)"

The President said that on going over the Sphingidae in the Tring Museum he had found there were two very large masses of the parasite, bred by the Rev. Myles Moss; and the moth on which it is found is *Pachylia syces insularis* Rothsch. Mr. Myles Moss bred the insect at Para from typical *Pachylia syces*, but as Dr. Waterston's examples came from the West Indies, they were doubtless fed on the island race of *syces*.

Mr. Lyell said the silk much resembled that of the silk-worm, and was quite as fine.

Letter from Mr. H. Powell, F.E.S.

The Treasurer read a letter he had received describing the entomological expedition on which Mr. Powell is at

present engaged on the Atlas, Morocco, recording many forms and species of Lepidoptera not met with by Mr. G. Meade-Waldo.

Mr. J. Hartley Durrant exhibited a series of *Blastobasis lignea* Wlsm., including the variety *adustella* Wlsm., taken by Mr. Albert E. Wright at Grange-over-Sands, 1918–1920. A few specimens were taken in August 1918, twelve more Aug. 10, 1919, and two on July 23, 1920. They were beaten out of the foliage of *Cotoneaster microphylla* Wallich—the larva probably feeds on accumulations of rubbish on this plant or on yew, which also occurred in the same place.

Blastobasis lignella was described by Lord Walsingham (P.Z.S. Lond., 1894, 550–1) from specimens collected in Madeira by Wollaston, fifty or sixty years ago, and Mr. Durrant was not aware that the species had been met with again until its capture in this country by Mr. Wright.

This is an exceptionally interesting addition, as it introduces also the family Blastobasidae to the British List.

Wednesday, May 4th, 1921.

The Rt. Hon. Lord Rothschild, M.A., D.Sc., F.R.S., etc., President, in the Chair.

Donations to the Library.

Donations to the Library were announced, and thanks given to the donors.

Election of a Fellow.

Mr. R. F. D. Tutt, M.R.C.V.S., F.R.M.S., F.Z.S., 1, St. Cross Rd., Winchester, Hants, was elected a Fellow of the Society.

Walsingham Medal.

Mr. J. H. Durrant presented to the Society an example of the Walsingham Medal, and a unanimous vote of thanks to him was passed.

Exemption from Rates.

The TREASURER read a letter from Mr. Chambers Leete, Town Clerk, Kensington, giving the Society the benefit of the Friendly Societies Act 1843, exempting it from the payment of Rates.

Exhibitions, etc.

Mr. A. DICKSEE exhibited an analysis of 50 specimens of *Papilio ascolius*.

(1) *Front Wing Variations.*—Subapical cell spot large, 8; subapical cell spot small, 10; streak in cell yellow, large and clear, 10; streak in cell small and clouded, 9; streak in cell orange, 2; streak in cell extends below cell at one point only, 1; streak in cell at three points, 2; all 3 spots beyond cell present, 7; No. 2 spot missing, 43; Nos. 1 and 2 spots missing, 5; discal spots large, 9; discal spots small, 6; nebulous marks at hind angle, 5;

(2) *Hind Wing Variations.*—Black margin meets cell, 13; black margin does not meet cell, 37; nebulous sub-marginal spots, 1; two front yellow spots dusted with black, 3; distinct black spot under costal streak, 2; least orange, 4.

(3) *Underside Hind Wing.*—Spot behind costal black streak, 28; costal streak very small, 2; orange brown all over, 22; very light, 4.

THE SUPERLINGUAE OR PARAGLOSSAE OF INSECTS.—Dr. GAHAN said that as he was unable to be present at the meeting when it was read, he should like to offer some remarks on Dr. G. C. Crampton's paper which appeared in the last issue of the Transactions of the Society. It had to do with at least one very interesting and important question; for on a correct interpretation of the structures known as the superlinguae or paraglossae would depend to a great extent what views should be taken in regard to the number of segments in the insect's head, and the position of the insects in relation to other Arthropoda. Vaysierre, from his investigation of them in a May-fly larva, was, he believed, the first to suggest that the paraglossae represented a distinct pair of head-appendages. That view, however, met with little acceptance before the publication, in 1893, of the important paper by

Dr. H. J. Hansen on the Morphology of the Limbs and Mouth-parts of Crustacea and Insects (Zool. Anz. 1893, and in Ann. Mag. N.H. 1893). In that paper, Hansen, who had carried out an investigation on the lines which Dr. Crampton recommends and apparently has followed, definitely put forward the view that the paraglossae, owing to their position and structure in the Thysanura and other primitive insects, represented a clearly distinct pair of appendages homologous with the first maxillae of Crustacea, and he proposed for both the name maxillulae. Prof. G. H. Carpenter, in more recent years, has brought forward further evidence in support of Hansen's view, and has given a figure of the maxillula of *Machilis*; showing a complex structure and three distinct lobes interpreted as lacinia, galea and rudimentary palpus. It is astonishing that Dr. Crampton without even once referring to Hansen in his paper, makes Folsom "apparently responsible" for the view maintained by Hansen seven years before Folsom's paper appeared. Dr. Crampton considers it to be a mistaken view; he asserts emphatically that the paraglossae (named superlinguae by Folsom in order to avoid confusion with the paraglossae of the labium, which are quite distinct structures) are *not* the homologues of the first maxillae of Crustacea at all, but represent their paragnatha; and he suggests that the paragnatha are detached lobes of the first maxillae. If the latter suggestion is to be taken seriously it would logically follow from his argument that the paraglossae of insects actually do represent the first maxillae of Crustacea, a conclusion which apparently is not exactly the one at which he wishes to arrive. Hansen, whose knowledge of the Crustacea is not to be despised, regarded the paragnatha as a typical median bilobed structure homologous with the hypopharynx (or lingua) of insects, also a median structure to the base of which the maxillulae are sometimes attached on the inner side. With regard to the interpretation of the parts of the maxilla of insects, which Dr. Crampton has given in correction of the "absolutely unfounded and incorrect statement which one encounters with disheartening regularity in the zoological and entomological textbooks," he believed that so far at least as this country was concerned, Dr.

Crampton was engaged in the effort of slaying a dead horse; and he would like to point out that Dr. Crampton's interpretation, arising from a comparison of the parts in *Machilis* with those of Crustacea, agrees entirely with the interpretation given by Hansen in 1893. That fact in itself suggested to him that Dr. Crampton had no first-hand knowledge of Hansen's paper, and was unaware of all the evidence in support of the particular view which he characterises as "a most glaring inaccuracy." He had no wish to prejudge the question at issue, and should await with the greatest interest the further papers, illustrated by drawings, in which Dr. Crampton has undertaken to give details, and prove the truth of his statements; it was certainly a strong point in favour of his view, that the presence of a neuromere, corresponding to a superlingual segment, in the embryo of *Anurida*, as shown in one of Folsom's figures, is very much questioned by other embryologists, and has not yet been confirmed.

Mr. S. Edwards brought for exhibition two larvae of *Ino globulariae*.

Mr. G. Talbot, on behalf of Mr. J. J. Joicey, showed some examples of new and little known Lepidoptera collected on the Island of Mefor by Messrs. C. F. and J. Platt; also some specimens from near Berne in Switzerland and from the Marianne Islands.

Mr. J. E. Mellor, M.A., Assistant Govt. Entomologist to the Anglo-Egyptian Sudan—a visitor—exhibited and read a note on certain Sudan Solitary Wasps.

"*Eumenes maxillosa* seemed to be the commonest in Khartoum during the period of my observations—April to July 1920—whereas the black and yellow waisted Sphegid, *Sceliphron spirifex*, was more frequently seen at Shambat, two and a half miles north of Khartoum and opposite Omdurman.

"*E. maxillosa* builds its nest on walls in or outside the house, on various articles of furniture, and I once found a round nest about the size of a tennis ball round a branch of a *Poinciana*, from which emerged wasps seemingly identical with those issuing from nests found on flat surfaces.

"This wasp and a Eumenid, possibly *E. lepelletieri* Sauss.,

build their elliptical pot-like cells in the same way. The ends of the ellipse are begun first, then the top gradually comes into being, and then the bottom is brought up to meet round a small hole left for insertion of egg and prey. In the case of *E. maxillosa*, a sessile funnel is made around this hole at the last building visit, but the other Eumenid gives hers a distinct neck at the last visit but one, and a graceful disc is added at the last visit.

"I have not observed *E. maxillosa* laying her egg, but have sketched *lepelletieri* in the act. Having completed the funnel, she turned and faced the wall on which her nest was built, and inserted the posterior of her abdomen into the funnel, curving it up towards the ceiling of the cell and moving it up and down, but never taking it out. The first attempt, which lasted about twenty seconds, seemed unsuccessful; but at the second, which lasted thirty seconds, she managed to attach the egg, and it could be seen hanging down in front of the centre of the hole. She then flew away slowly as if the operation had tired her. Later she returned with a caterpillar of *Catopsilia florella*, which lives upon the Sennas—*Cassia obovata* and *acutifolia*. The cells of this wasp are somewhat smaller than those of *E. maxillosa*, but both stock their cells with caterpillars of this white butterfly, and in those which I have opened the number has been three. These caterpillars are imperfectly paralysed and can wriggle a little, cling to the surface on which they stand, void excrement from food eaten before they were stung, and, in some cases, pupate—though the larval skin often gets caught at either end, and bends them into the shape of a bow. The longest time that a paralysed caterpillar from the cell of *E. maxillosa* remained fresh was nine days, so that the egg and larval stages of the wasp could not well have lasted much longer. *E. maxillosa* took twenty-four to twenty-six days to emerge, but only parasites did so from the cells of *E. lepelletieri*.

"When the egg has been laid and the cell stocked the wasp closes the hole, destroying the funnel completely. The surface is smoothed over level with the rest of the cell, but the difference in the age of the mud still reveals the spot to the human eye. When all the cells are finished both wasps

cover the whole with an outer coating of mud: *E. maxillosa* with a granular one, *E. lepelletieri* with an almost smooth one, whilst *S. spirifex* covers her cells with a patchwork, each patch being quite smooth and representing one pellet.

"*Sceliphron spirifex* builds cigar-shaped cells, into which she puts fourteen to sixteen spiders, chiefly Epierids with a few Attids, the egg being laid on the first spider put into the cell. One of these wasps had her nest in a room, and when the doors were both closed went through a small hole at the side of the door. If one of the doors was open, she flew out through the large space of light, but whether it was open or shut, on entering she always negotiated the narrow and difficult passage through the small hole at the side, showing that she had not profited from experience of the outward journey.

"*Salius lynx*. This Pompilid was seen hunting the lawns and banks of irrigation channels like a working spaniel. I have seen one try to tempt a wolf-spider from its lair by feeling with its fore legs, cat-like, round the edge of her hole. Next day I saw one pull an already paralysed wolf-spider some fifteen yards up a bank, through a hedge, and down a hole within a few inches of the Nile. She walked backwards, pulling the spider head first. After some ten minutes a cricket came out of this hole. The wasp did not come out and the river rose above the spot during the night.

"*Rhyncus* sp. Saw a pair copulating on a leaf some three feet from the ground. The male flew off afterwards with a wild vigorous flight and a loud buzz. Nest found in an old Dervish fort, with funnels about two to three inches long, turning downwards and at right angles to the hole in the wall. *Megachile mephistophelica* in some cases seemed to have usurped these funnels and lined them with her leaves. She might sometimes be seen peeping out of the end of a tube as if to see whether the coast was clear."

Mr. Mellor's remarks gave rise to a discussion on the formation of nests by mud wasps, in which Messrs. Janson, Greene, Morice, and Dr. Marshall took part.

Prof. T. D. A. Cockerell made some observations on the

distribution of Coleoptera in Madeira, and read the following notes on a Journey to the Madeira Islands.

"Ever since I visited Madeira in 1879, I had longed to return and further investigate its natural history. The chance came last December, and my wife and I were able to spend nearly three months on the islands, including a couple of weeks in Porto Santo. The winter season is not the most favourable, but flowers bloom all the year round, and insects may always be obtained. It is not yet possible to report at all fully on the collections, but some interesting facts have come to light.

"Off the island of Porto Santo are several smaller islands, almost every one having one or more forms of snails entirely confined to it. These snails may be regarded as races of species of the main island in the majority of cases, but *Gesmitra turricula* of the Itheo de Cima is a very distinct and remarkable species. This endemism, in islets quite near the shores of Porto Santo, is most conspicuously exhibited by the snails, but we were able to find some evidence of it among the apterous Coleoptera living under rocks. These beetles were determined with the kind assistance of Mr. K. G. Blair at the British Museum, using the materials in the Wollaston and general collections for comparison. The genera concerned are *Helops* (Tenebrionidae) and *Scarites* (Carabidae).

"*Helops* is represented in the Madeiras by a peculiar group, which has been placed in the subgenus *Nesotes* Allard. The exception is a single specimen of *H. pallidus* Curtis in the Wollaston collection from Porto Santo; it has not been found there since, and was doubtless introduced. *Nesotes* has, outside of the Madeiras, several species in the Canaries, one in the Azores, and one in the Balearic Islands. The group thus appears to belong to the so-called Atlantic fauna, and probably dates back to the beginning of the Tertiary. Wollaston had already observed a high degree of local endemism among the species of *Helops*. Three species are from Porto Santo only. He did not, apparently, investigate the forms of the smaller islets. The small Itheo de Nardeste, which has two kinds of snails peculiar to it, also proves to have a *Helops*, which may be defined thus :—

" *Helops lucifugus maritimus* subsp. n. Resembling *lucifugus* Woll., of Porto Santo, but more elongate and with subparallel sides, elytra more convex, surface more shining. The sculpture of the prothorax, with weak punctures on a shining surface, shows its relationship to *lucifugus* rather than to *H. infernus*, which has crowded strong punctures. ♀ 11·5–12 mm. long, nearly 6 mm. wide. ♂ 9 by about 4·4 mm. Type in British Museum, collected January 1921. Cotype retained for U.S. Nat. Museum.

" A species of *Hadrus* was also found on the I. de Nardeste, but it must be referred to *H. illotus* Woll., common on Porto Santo. The specimens are narrower than usual, thus varying in the same direction as the *Helops*. On the other islets the *H. illotus* also show incipient differentiation; thus those on I. de Cima are conspicuously larger than those on I. de Baixo, here varying in a direction parallel with the *Scarites* just to be mentioned.

" *Scarites abbreviatus* Dejean, occurs on all the islands, that is, on Madeira, Porto Santo and all three Desertas. In Madeira I took it near the Pico de Serrado, at an altitude of about 3000 ft., Jan. 31. Facing the two ends of Porto Santo, and separated from it by narrow channels, are the islands called Cima (upper) and Baixo (lower). The latter is considerably the larger, but appears to be more barren, lacking the shrubby *Artemisia argentea* L'Herit., which abounds on Cima. Poor specimens of *Nicotiana glauca* Graham occur on Baixo; the plant was introduced there several years ago by Juan de Pico of Porto Santo. *S. abbreviatus* abounds under stones on both these islets, but whereas those on Baixo are about 19–20 mm. long, somewhat smaller than the Madeira form, those on Cima are gigantic. There are, in all, four distinct races of *S. abbreviatus*, which may be separated thus :—

Large forms.

" *S. abbreviatus cimensis* subsp. n. The large form of the I. de Cima, not known to Wollaston. It is about 29 mm. long, and has the base of the elytra without the numerous granules of the Madeira form, but with a few irregular punctures. The mesal expansion of the left mandible has a variable but

distinct large rounded apical lobe, not developed in the Madeira form. Type in British Museum; the cotype will be placed in U.S. Nat. Museum.

" *S. abbreviatus desertarum* subsp. n. This is Wollaston's var. δ from the Desertas. It is larger and looks like *cimensis*, but the mandibles differ, and, as Mr. Blair pointed out, the margin of the thorax is broadly interrupted posteriorly. In *cimensis* the margin is suddenly deflected or bent at a point behind the middle of the prothorax, apparently indicating that the structure is produced by two separate factors in inheritance, one of which has dropped out in *desertarum*. Type in Wollaston collection, Brit. Museum.

Small Forms.

" *S. abbreviatus partosanctanus* subsp. n. This is Wollaston's var. β, but I take as the type one of my specimens from Itheo de Baixo, Jan. 22, 1921. It is the smallest of the races, 19–20 mm. long, but resembles the Cima one, and not that of Madeira, in the sculpture of the base of the elytra. As Wollaston remarks, the elytra are also more broadened posteriorly. The mesal lobe of the left mandible lacks the apical lobe or expansion, but differs from that of the Madeira form in being more obtuse, with its upper face obliquely striate. Type in British Museum; cotype kept for U.S. Nat. Museum.

" *S. abbreviatus*, typical form from Madeira. Wollaston also distinguishes a variety from the Itheo de Fora, at the end of Madeira, opposite the Desertas.

" I exhibit a few other insects, interesting for various reasons :—

" *Bombus ruderatus* (Fabricius). Fabricius described his *Apis ruderata* partly from material collected in Madeira by Sir Joseph Banks, on Captain Cook's first expedition. It was interesting to find the same species in abundance in a meadow at Funchal, March 2, 1921. It was visiting flowers of *Echium*.

" *Rhyparobia maderae* (Fabricius), also described in the early days from Madeira, but now cosmopolitan. It probably did not originate in Madeira. The specimen is from Funchal.

" *Chrysomela banksi* Fabricius, collected by Mr. A. C. de Noronha on the right bank of the Ribeira de Porto Novo,

Madeira, November 1918. It is new to Madeira, but has doubtless been introduced from Portugal.

" *Chrysophanus phlaeas* (L.) collected by my wife at Porto da Cruz, Madeira. G. T. Bethune Baker states that Wollaston's specimens of this species from Madeira were very dark, but those we saw had a very ordinary appearance. Rebel refers the Madeira form to the race *phlaeoides* Stgr."

Wednesday, June 1st, 1921.

The Rt. Hon. Lord Rothschild, M.A., F.R.S., etc., President, in the Chair.

The President announced the death of Dr. Longstaff, and a vote of condolence was passed to his widow and relatives.

Election of Fellows.

Dr. David Sharp, M.A., M.B., F.R.S., etc., was elected a Special Life Fellow. Mr. P. V. Castling, of Peshawar, India, and Dr. S. C. Harland, D.Sc., of Shirley Institute, Didsbury, were elected Fellows of the Society.

Exemption of the Society from Income Tax.

The Treasurer made a statement, explaining that the Society, as a Friendly Society, had been pronounced free from all Income tax except on the interest on the Debentures. He also made a statement as to the portraits of Distinguished Entomologists that had been hung in the Society's rooms, and expressed the hope that other portraits and documents of entomological interest would be presented to the Society.

Obituary.

The President read the following statement as to the death of a number of distinguished Russian entomologists during 1916–20 :—

	Speciality, or position	Date of death
N. N. Adelung . .	Keeper of Orthoptera in the Petrograd Zoological Museum.	23.xi.17.
S. N. Alferaki . .	Lepidopterist.	27.vii.18.
V. L. Bianki. . .	Zoologist of the Petrograd Mus.	10.i.20.
E. M. Vassiljev . .	Professor, economic entomologist.	vii.19.
N. A. Zarudny . .	Traveller in Central Asia and Persia.	13.iii.19.
B. A. Karavajev . .	Myrmecologist.	1919.
A. K. Krulikovsky .	Lepidopterist.	x.20.
N. V. Kurdjumov .	Economic entomologist.	7.ix.17.
V. Oshanin . . .	Hemipterist.	26.i.17.
T. Portchinsky . .	Chief of Bureau of Entomology	8.v.16.
E. Pylnov . . .	Orthopterist.	1920.
V. Rodzjanko . .	Forest entomologist.	1919.
M. N. Romanoff . .	Grand Duke, Lepidopterist.	29.i.19.
A. A. Silantjev . .	Economic entomologist	21.iii.18.
D. A. Smirnov . .	Coleopterist; economic entomologist.	17.viii.20
A. A. Sopotsko . .	Economic entomologist.	1.iv.19.
G. Suvorov . . .	Coleopterist.	29.v.18.
J. Schreiner . . .	Economic entomologist.	vii.18.
N. A. Cholodkovsky .	Professor of Entomology and Zoology.	2.iv.21.
Th. Stcherbakov . .	Economic entomologist.	ix.20.
J. Shevyrev . . .	Chief of the Entomological Laboratory of the Department of Forestry	7.vii.20.

Exhibits.

The recurrence and wide distribution of a particular type of variation in Pyrameis cardui L.—Prof. Poulton exhibited two examples of the var. *elymi* Ramb., one captured Jan. 18, 1921, in a valley on the east side of Porto Santo (about 500 ft.) by Prof. T. D. A. Cockerell, and another, from the New Forest, in the Dale Collection. Also a specimen intermediate between *elymi* and *cardui*, taken (1901–1910) at Guimar, on the east side of Tenerife (about 1200 ft.), by Mr. W. Walmesley White. All these examples were in the Hope Department. In the British Museum there was an *elymi* (figured by Mr. R. South in his "Butterflies of the British Isles") taken at Dover, in the Eustace Bankes Collection, and an intermediate variety like that from Guimar, purchased by Mr. J. H. Leech in Berlin. Lord Rothschild possessed an example of *elymi*, also from Dover. Further-

more, most of the rather garish figures of *cardui* vars. in S. L. Mosley's "Varieties of British Lepidoptera" (1878–1885) were clearly forms of *elymi*.

Comparing the examples it became obvious that *elymi* was itself extremely variable. The two Oxford specimens exhibited to the meeting were very different, and that from Porto Santo remarkable in the straight-cut outer margin of the hind-wing. But, in spite of much individual difference, the pattern as a whole was the same and the same markings became dyslegnic which were eulegnic in *cardui*.

Whether by reversion, which seems to offer the more probable hypothesis, or by spontaneous variation following some line of genetic least resistance, it was obvious that isolated communities of *cardui* tended to produce from time to time individuals transitional towards *elymi*, or *elymi* itself.

Asclepias curassavica L., sought by the imago of Papilio homerus F.—Prof. Poulton exhibited examples of this Asclepiad, well known in the tropics of both hemispheres, collected by Mr. Scoresby Routledge in April 1921, at about 800 ft., from open grassy meadow-land on the John Crow Mountains, Jamaica. The interest of the exhibit lay in the following note sent with the specimens :—

"*Papilio homerus* sucks the nectar from the blossom, swaying down the plant by its size and weight. One was observed going to twenty plants in immediate succession, *i. e.* to all the plants in bloom on the spot."

Libythea probably L. laius Trim., congregating, perhaps before or during migration.—Prof. Poulton said that he had received the following note from Mr. C. F. M. Swynnerton. The observation was made on the Miombo-Kilossa Road, Tanganyika Territory. The facts recorded and referred to in Trans. Ent. Soc., 1921, pp. 404, 405, made it probable that the habit described was associated with migration. The late Mr. Farquharson's observation that the migrating W. African *Libythea labdaca* Westw., settled in culverts (*ibid.*, p. 405) supported Mr. Swynnerton's suggestion that some inorganic substance was sought by butterflies of this genus, as it is believed to be by many Hesperidae.

"*Dec.* 24, 1920.—*Libythea*, apparently *laius*, is here some-

times in great numbers and on Dec. 5, 1920, the afternoon of the day before the Cicada observation, we came on a bare tree, apparently also *Combretum*, in the same woodland formation [see p. lxiv], the twigs of which were literally covered with *Libythea*, some resting, some flying off and back to the tree. It rather reminded me of my *Amauris* observation at Dar-es-Salaam, but the congregation was certainly not for shade, for it was one of the least shady spots and the afternoon was very dull with rain threatening. Had a brood lately emerged at and about a food-tree there,—were they congregating to facilitate mating or what? In Rhodesia I used to get it chiefly in and on the outskirts of primary forest. Here [at Kilossa] we get it in open *Combretum* and *Brachystegia* wooding and in great numbers at damp ground beside my house, in an open clearing. Why this difference? It seems obvious that shade is not the factor that determines the butterfly's presence. It may be the presence of food-plant. Its remaining in numbers for long together 50 yards from the nearest trees or shrubs is also interesting in view of its protectively-coloured under-side.

"*Jan.* 2, 1921.—Still not posted! I caught a long series of *Libythea* to-day, being Sunday, and seeing that I got them 50 at a time in my net! The variation of the under-sides is most interesting, and, like that of the still more variable Catocaline moth, *Achaea lienardi* Boisd., runs to definite patterns and a limited number of them, and the breeding I am sure is on 'Mendelian' lines. Also I am sure this variation is of use to the insect, since it prevents birds getting accustomed to looking out for a particular *type* of dead leaf or protective pattern.* I had some experimental evidence in favour of this view.

"The Libytheas settle in huge numbers where the boy washes the clothes (soap is distributed around) and where cement has been thrown out. Is it possible that alkali is needed by them?"

The courtship of the Cicada, Monomatapa insignis Dist. (Tibicinae), observed in Tanganyika Territory.—Prof. Poulton said that he had received the following notes

* See Poulton: "Essays on Evolution," Oxford, 1908, p. 310.

from Mr. A. Loveridge and Mr. C. F. M. Swynnerton. He also exhibited 2 ♂♂ and 4 ♀♀ sent by these naturalists, and called attention to the beautiful structure of the sound-producing organ.

"*Miombo-Kilossa Rd.*, 6.xii.19. At a point about two miles from Kilossa at 7 a.m. the noise of these insects was perfectly deafening. I have never heard such a chorus of insect life; great numbers were flying about the tops of the trees, and they were settled on all the small bushes in considerable numbers. When a pair were together the courting male took up a position on the underside of the twig or branch, whilst the female was directly above. The male would then move round to the upper surface and pairing would take place. A pair of Wood Hoopoes (*Irrisor erythrorhynchus*) disporting themselves in the trees, added to the din. A. L."

Mr. Swynnerton's observations, made on the same occasion, were contained in a letter of Dec. 24, 1920 :—

"I will add to Mr. Loveridge's note my own memories of the observation. Personally I saw the Cicadas courting also on vertical twigs, though the horizontal position was more usual. The male always headed in the same direction as the female. The stridulation was distinctly to charm the female into acquiescence, for the male continued it steadily, his whole body vibrating, until at last he came round and gently attempted copulation. In one instance, in which he failed—owing apparently to the female's not having been brought to the necessary pitch of sensuality—he went back and sang again, the female still remaining. The courtship lasted a very long time in each case watched, certainly ten or fifteen minutes and probably often far longer. The insects were very easily captured by hand when *in coitâ*, attempting to escape in most cases merely by falling or gliding to the ground together, but were wary and readily disturbed while still courting. It was between seven and eight in the morning and more or less sunny. The woodland formation was tree-savannah—the pasture grasses, already eight to twelve inches high after burning and thunder-showers, and the open tree and shrub growth dominated by thorny *Acacia*, *Dalbergia*, and *Combretum*, all coming on well in young leaf. I did not note any

real preference for a particular species of tree, though the majority of the couples watched happened to be in one or two rather bare *Combretum* trees standing together. However, they were found also in the other trees and shrubs immediately round, at any distance from the ground, from four or five feet to the full height of the trees—twenty-five or thirty feet. The *Combretum* in question is non-thorny, a fact which may be contrasted with some previous observations on Cicadidae.

" In one case definitely I noted two males courting one female, the three of them shoulder to shoulder round a small, vertical twig, and both males calling *simultaneously*—as was evident from the strong vibration of both. On the female's flying off, as she did after I had already seen her sex, the males continued to call and in doing so moved opposite to each other, into the position usually taken up by a courting pair. I did not see females coming to calling males, though this has of course been recorded—at any rate for certain species. In the case of two males to one female,—and I think I saw one or two other apparent cases of it out of reach, though I can't trust my memory sufficiently to say so definitely now—it seems obvious that at least one of the males must have come to the female. It is unlikely that one just happened to find two of them together, and with so many Cicadas congregated in a small space it is very possible that the males were finding the females—by other senses than sound. Unluckily the whole ceremony was in an advanced stage when we got there, and we could not wait long.

" This collecting together in great numbers for courtship is interesting. I have seen it on other occasions, and besides probably giving the males opportunity to find the females as well as to be found by them, it certainly lends colour to the view that there is competition for the females in the matter of song. It would be interesting to see instances in which a male was finally refused yet another male accepted. Unfortunately I was unable to see the courtship through in which a male, apparently rejected, tried again. But, seeing that the courtship takes so long, the male who has to charm long to make the required impression will probably pair with fewer females in his lifetime, even if he *never* gets finally

rejected, than the brilliant charmer who gets accepted at his first advance. One really requires to give several hours to such an observation as the one I have described.—C. F. M. S."

Coprid beetles believed to be internal parasites of man. The wiles of "medicine-men."—Prof. Poulton, in bringing forward the following communication from Mr. C. N. Barker of the Durban Museum, said that he believed an analogous form of deception was practised by the Australian medicine-men, the foreign objects palmed off by them being bones, pieces of wood, etc.

"*May* 3, 1921.—A short time ago (3.iii.21) we received from Mr. Franks, of Tugela, Natal, a small bottle containing a large number of dung-beetles, which I determined as *Onthophagus suggilatus* Klug, *O. lutulentus* Har., *O. parumnotatus* Fahr., and some small *Sisyphus; suggilatus*, which is the smallest species, formed the bulk of the collection, but there were also a considerable number of *lutulentus*, a medium-sized insect. These Mr. Franks states were passed alive with the excreta of a native woman after the employment of a native herb medicine used principally as an enema and a small portion taken internally. The medicine of course was administered by a native doctor, and the woman had been sick with internal troubles for over three months.

"In the 'Annals of the Natal Museum,' vol. ii, 1909, there is a comprehensive paper on Zulu medicine and medicine-men by the Rev. Alfred T. Bryant, and under the heading 'Intestinal Parasites' he has the following:—

"'*iKhambi.*—There is a complaint comparatively common among the Kafirs of these parts which seems to be unknown to medical science. It appears to be caused by an intestinal parasite called by the Zulus iKhambi (sometimes iGhotho or iBhungane). This is an imago of a beetle measuring from a $\frac{1}{4}$ to $\frac{1}{2}$ an inch in length, with greenish-black elytra. The beetle is almost identical in appearance with the dung-beetle found in fresh cow-dung. Specimens of the beetle were obtained by me in June, 1903, at first hand from a sick native girl in my charge in Zululand, who had been passing them periodically in as many as a dozen or more at a single evacuation throughout a period of ten years or more. The specimens

were submitted to Dr. Warren of the Natal Museum, Maritzburg, and they were sent on by him to Dr. L. Péringuey, the well-known Coleopterist of Cape Town. All the information that these gentlemen could impart was that the insects appeared to be a species of an ordinary dung-beetle (*Aphodius marginicollis*).'

"There is much more on the subject contained in the article, which, if you can get hold of it, might interest you. I am sending you all this to show you how gullible some white men are, when confronted with the trickeries of some of these wily native medicine-men. If you read the rest of what Mr. Bryant says on the subject you will notice that these doctors must use a considerable amount of dexterity in the way they immediately transfer their live stock to the passed excreta to keep up the deception."

In view of the facts brought forward by Mr. Barker, the statement made by R. A. Senior White, in "The Indian Journal of Medical Research," Calcutta, Vol. 7, No. 3, p. 568, required confirmation, and was, on the face of it, highly improbable. The "disease," as it is there stated to occur in Ceylon, was curiously similar to that described in Africa, and there was a vernacular name ("Kurumini Mândâmâ" = "Beetle-disease") in the former as in the latter. Mr. G. J. Arrow had informed Prof. Poulton that the beetle, said to have been passed by a boy in Matale Hospital and figured on Plate LV, was certainly *Onthophagus bifasciatus* F. (probably a ♂ and not, as represented, a ♀), but that the other two figures supposed to be of the same species were different from it and from each other.

Mr. Donisthorpe exhibited a specimen of *Argynnis euphrosyne* taken *in cop.* at Darenth Wood on May 10, 1921, pointing out that it still retained part of the pupal sheath on the head, but was able to fly. Some discussion arose as to the effect of damage to the antennæ on the flight of butterflies.

Eversible glands in Chrysomelid larvae.—Dr. C. J. Gahan exhibited larvae of the Chrysomelid beetle, *Phytodecta viminalis* L., and said his object in doing so was to call attention to the existence in these larvae of a glandular structure, which under certain conditions was everted between the 7th and

8th tergites of the abdomen. The gland when everted gave off two branches which stood erect to a height of nearly a mill metre, and, being of an orange colour, were quite easily seen with the naked eye. Eversible glands of a somewhat different kind, and very much smaller in size, were known to occur in the larvae of *Lina populi* and some other species of Chrysomelidae, where they formed a series along each side of the back, each gland being slightly everted from a minute opening at the top of a small conical tubercle; these glands each exuded a milk-white drop of liquid, which had an odour like that of bitter almonds, and was said to contain salicylic acid. The larvae of *Phytodecta* which he was exhibiting were given to him by Mr. Champion, who found them, together with the beetles, on their food-plant, a species of *Salix;* and he had not himself observed them under natural conditions. While investigating one of the larvae to see if it had glands like those of *Lina*, he touched it with a brush dipped in benzene, and almost immediately its glands were shot out, and thus brought to his notice. It was subsequently found that when a larva was squeezed between the fingers, or with a pair of forceps, its glands were also everted, but were not brought into view when the larva was poked about, or turned upside down, with a brush or even with the point of a needle. Xylol, applied with a brush, had the same effect as benzene; but ether, chloroform, alcohol, formalin, or vinegar, applied in the same way, failed to make the larva evert its glands; and yet in each case when benzene was afterwards applied, the glands were quickly everted. By placing a larva in a cell under a glass cover-slip and then touching it with a drop of benzene, it was seen that where the glands came in contact with the glass two small drops of a clear, transparent liquid were left behind, which slowly evaporated, a faint deposit remaining on the glass. The larvae of *Phytodecta viminalis* had been more than once described, but he had nowhere come across any reference to their eversible glands. These glands, like so many others of a similar character met with in insects, doubtless served as a protection from predaceous or parasitic enemies; but why benzene in particular should have such an effect in

bringing them into action he did not at present understand. They gave off no appreciable odour, and their effect on the enemy would seem to be through its sense of taste rather than its sense of smell.

Mr. C. B. Williams in commenting on this exhibit said that he had found *P. viminalis* to be viviparous.

British Hymenoptera.—The Rev. F. D. Morice exhibited :—

A ♂ of the sawfly *Tenthredopsis palmata* Geoffr., with a second transverse nerve abnormally present in the radial cell of its right fore-wing. This seemed to be a case of "reversion," such a nerve being believed to have been present in the original ancestors of this group, though it occurs normally only in one small and very peculiar division of it, viz. the Xyelini.

The specimen was taken (or bred?) by the Rev. W. J. Johnson recently at Poyntzpass, Co. Armagh, Ireland.

A ♂ of *Lasius* (= *Anthophora*) *pilipes*, which he saw in his garden, a few weeks ago, making repeated and violent attempts to seize (and pair with?) a ♀ of the Humble Bee *Bombus pratorum*. In most years ♂♂ and ♀♀ of *pilipes* are exceedingly common at Woking, as they are almost everywhere, in all months of the spring. But this year Mr. Morice had seen only a very few ♂♂, and not a single ♀ either in his garden or elsewhere.

Mr. Morice exhibited also a ♀ of *pratorum*, and the real female of *L. pilipes*. It was seen that they differed very considerably in colour as well as in structure!

Mr. Morice stated that Dr. R. C. L. Perkins had told him that he had seen *pilipes* ♂ behave in the same way, not only towards Humble Bees, but, what seemed still more curious, towards workers of the Hive Bee!

Pierines from Central Peru.—Dr. F. A. Dixey exhibited some Pierines from West Central Peru, and remarked on them as follows :—

"The butterflies now exhibited, with several others, were all captured on the same day, May 26, 1918, by Mr. G. H. Bullock, near the Palca torrent, above its junction with the Chanchamayo river, at an elevation of about 5000 ft. The three specimens of *Pereute*, though bearing so strong a

resemblance to each other, belong to three different species—*P. leucodrosime* Koll., which has antennae ringed with white, and basal red spots beneath; *P. callinice* Feld., which has black antennae and no red spots; and *P. callinira* Stdgr., also with no red spots, but with antennae like those of *P. leucodrosime*. Besides the characters just mentioned, these species are usually distinguishable by their scent-scales. The lamina in each of the species is long and narrow, more or less expanded towards the base, and furnished with basal cornua. The fimbriae are short. In *P. leucodrosime* the cornua are long and slender; in *P. callinice* they may be claw-shaped; in *P. callinira*, though sometimes strongly resembling those of *P. leucodrosime*, they are in most instances unsymmetrical, one being claw-shaped as often in *P. callinice*, the other long and tapering. The lamina itself is relatively narrower in *P. callinice* than in the other two species, and in *P. leucodrosime* the expansion towards the base is more gradual. Individual scales may not always be easy to place; but when a preparation contains many scales from the same specimen, it is not difficult to assign it to its proper species. It is interesting to note that in the matter of the presence or absence of red spots beneath, *P. callinice* and *P. callinira* agree, while *P. leucodrosime* stands apart. In the antennal character, *P. leucodrosime* and *P. callinira* agree, and *P. callinice* differs. As regards the scent-scales, *P. callinice* is somewhat intermediate between the other two, but on the whole comes nearer to *P. leucodrosime*.

"It may be worth noting that Seitz (p. 66) says: '*P. callinira* Stdgr. aus Peru hat schwarze Fühler.' But Staudinger, who described the species, says: 'die Fühler sind gelblichweiss,' which is undoubtedly the case.

"The other two Pierines are a male and female of *Pieris pharetia* Fruhst., the Peruvian form of the well-known *P. buniae* of Brazil. They differ from typical *P. buniae* chiefly by their larger size and by the pale and almost obsolete marking of the underside. The Natural History Museum has four male specimens of this form from Bolivia, but no specimen of the female."

Examples of Heliconius from Venezuela. Mr. George

Talbot exhibited on behalf of J. J. Joicey, Esq., forms of *Heliconius* showing the transition from *erato molina* Smith to *erato chestertonii* Hew.

1. *H. erato molina* Smith. Venezuela.

2. An aberration of *molina* with the band of the fore-wing partly obliterated. Venezuela.

3. An aberration of *molina* with only a subcostal red dot on the fore-wing. Venezuela.

4. Aberr. *nocturna* Riff.—Fore-wing with a subcostal yellow dot. Hind-wing with traces of a yellow discal band between vein 2 and the inner margin, on the underside extending to the outer margin. Venezuela.

5. *H. erato chestertonii* Hew. Colombia.

Papers.

The following papers were read :—

"Mimicry of Ants by other Arthropods," by H. Donisthorpe.

"Erotylid Coleoptera," by G. J. Arrow.

It was decided not to hold the informal meeting provisionally arranged for the 15th June.

Wednesday, October 5th, 1921.

The Rt. Hon. Lord Rothschild, M.A., F.R.S., etc., President, in the Chair.

The President announced that owing to the illness of Mr. H. Rowland-Brown, Dr. H. Eltringham, M.A., D.Sc., F.Z.S., had kindly consented to act as joint Secretary for the remainder of the session.

Gifts to the Society.

The Treasurer called attention to two portraits that had been bequeathed to the Society by the late Dr. Longstaff. A vote of thanks to Mr. J. J. Joicey, F.L.S., F.Z.S., F.R.G.S., for his generous gift of a lantern to the Society was passed unanimously.

Election of Fellows.

The following were elected Fellows of the Society :—

Messrs. Charles L. Fox, 1621, Vallejo St., San Francisco, California; William F. N. Greenwood, Lautoka, Fiji; Henry W. Dobson, 14–16, Finkle St., Kendal; Kalidos D. Shroff, Nahani, Surat, India; Arnold Roebuck, Edgmond, Newport, Salop; the Rev. J. Wesley Hunt, 116, Cross St., Kroonstadt, Orange Free State; and Miss Amy Castle, Assistant Entomologist, Dominion Museum, Wellington, New Zealand.

Exhibits.

Note on the Habits of the Bee, Anthidium manicatum.—With reference to a recent note by Mr. Morice on the pugnacity of a bee, a male of *Anthophora pilipes*, which attacked a female of *Bombus pratorum* (Proc. Ent. Soc. Lond., 1921, p. lxix), Mr. E. E. Green read the following extract from his Journal, dated 30th June : "A patch of *Nepeta cataria*, in my garden, is frequented by bees of the species *Anthidium manicatum*. The males have a peculiar flight, frequently poising themselves motionless in the air. They appear to be of an extremely pugnacious disposition. When a 'bumble bee' (*Bombus* sp.) approaches the patch of flowers, the *Anthidium* poises itself for a moment, takes aim, then launches itself straight at the intruder, striking it with such force that the *Bombus* often loses its balance and falls to the ground, after which it picks itself up and makes a hurried departure. The *Anthidium* does not follow up its victory or exhibit any further interest in its fallen foe, but resumes its previous occupation of cruising about above the patch of flowers, occasionally refreshing itself at a blossom."

Mr. Morice has suggested, as explanation of the action of his *Anthophora*, that this male mistook the *Bombus* for a female of its own species, but Mr. Green did not think that this explanation would fit the case just described. In the first place, the female of *A. manicatum* is much smaller than the male, while the individuals of *Bombus* that were the objects of attack were considerably larger and more brightly coloured

than the *Anthidium*. Further, the fact that the *Anthidium* took no further interest in the vanquished *Bombus* does not suggest that its action was due to sexual instinct. The conclusion arrived at is that the *Anthidium* wished to preserve this particular patch of flowers for the benefit of itself and its congeners, and resented the intrusion of outsiders.

British species of Zygaena.—Mr. T. H. L. Grosvenor exhibited the following :—

(1) A small race of *Zygaena trifolii* from Sussex, compared with a large race from Kent; it was found that these two races were unable to pair although readily attracted to one another.

(2) A black form from Sussex; it was found that these would only pair *inter se* with the greatest reluctance, and when finally obtained the resulting ova were infertile; it was also noted that a normal male preferred a black female and would not pair with a normal individual if a black one was present. Microscopic examination of the scaling showed this form to be normal.

(3) With a white female it was found impossible to obtain a pairing, as it did not seem to exhibit any sexual attraction, and males that readily paired with normal individuals showed not the slightest attraction. The scaling was found to be very sparse, and such scales as were present were curled.

(4) A male with spot 4 missing from the left primary.

(5) Teratological examples, including a male with wings small and almost circular, and a black male with wings fully developed but those on the left smaller than on the right.

(6) Two males with a number of white scales mixed with the red of the maculae; these were found to be different to exhibit No. 3, as these white scales were quite normal.

(7) A male *Z. tutti* and a female of *Z. trifolii* taken *in coitû*. Six imagines, the result of this pairing, were shown, altogether 19 were bred with the following results :—

All the females resembled the female parent.

50 % of the males resembled the female parent.

50 % of the males had a well-defined but small sixth spot.

A pairing between these was found to be infertile.

(8) Two males found *in cop.*, one *Z. tutti* and one *Z. trifolii;* they remained together at least 12 hours; the genitalia,

also exhibited, were found to differ in several important characters.

(9) A series of *Z. trifolii* and *Z. filipendulae* showing transitional forms between the two species, in the gradual decrease of breadth of border to secondaries and also in the appearance of the sixth spot, starting from two or three red scales and gradually increasing in size until it reaches the well-developed spot characteristic of the Aberdeen race of *Z. filipendulae*. It was found to be practically impossible to differentiate the overlapping forms without recourse to the genitalia. It was also suggested that *Z. tutti* if not identical with *Z. filipendulae* was extremely close to it, and that Tutt's theory that it is an offshoot of *Z. trifolii* is impossible. It was found that *Z. tutti* would readily pair with *Z. filipendulae* and that *Z. tutti* would rarely pair with *Z. trifolii*, but that up to the present it had been found to be impossible to obtain a pairing between *Z. filipendulae* and *Z. trifolii*. It was pointed out that the different dates of emergence may have something to do with this, but it certainly seems likely that *Z. tutti* holds an intermediate position in the line of fertility between the two distinct species *Z. trifolii* and *Z. filipendulae*.

Dr. Cockayne also commented on the difficulty of deciding the identity of *Z. tutti*.

Danaida chrysippus L., captured and then rejected by a young Shrike in S. Africa.—Prof. Poulton said that he had received the following record from the Rev. G. Cecil Day. About the end of May, 1915, Mr. Day saw a young Fiscal Shrike—*Lanius collaris* L., as Prof. Poulton was informed by Mr. Charles Chubb of the Natural History Museum—eagerly capture and then instantly reject with much apparent disgust a specimen of *D. chrysippus*. The observation was made in the grounds of the Modderpoort S.S.M. Brotherhood, Orange Free State.

The insect food of the Trout.—Prof. Poulton exhibited the specimens referred to in the following abstract by Dr. R. C. L. Perkins, F.R.S., of his paper in the Journal of the Torquay Nat. Hist. Soc., 1921, p. 15 :—

" The trout from which the specimens were obtained were caught by myself, in Aug. and Sept., 1920, mostly in the heat

of the day—11 a.m. to 5 p.m. summer time—in the reservoirs which supply the town with water. They are on the edge of Dartmoor near Lustleigh, probably 800 ft. or more above the sea. In all nearly 150 trout were caught, the larger number of which were examined. These particular trout were chosen because of the local interest, but in previous years I had been examining the food and food-supply of the fish in the Teign and Avon, this being very different from that of the reservoirs. While the food of the river trout consists largely of true water-insects, the reservoir trout subsist largely on land-insects, accidentally fallen into the water. In cold, bad weather they must get very little food, but when the ants are swarming, spiders 'flying,' and dung-beetles of the genus *Aphodius* filling the air, the water is covered with insects. Minnows are very abundant, but none of the fish examined contained any, though one had swallowed a newt. The bad 'rising' qualities of the trout are often put down by fishermen to the abundance of minnows, but are really due to absence of water-flies to bring up the fish to the surface, the water being very deep. When a 'minnowing' trout is observed, it will generally rush at once at an artificial fly, such as a red palmer, and is easily caught and generally large. The largest fish caught was 3 lbs. 1 oz.; the weather was bad then and had been so on the previous day and land-insects were not active. This was the only fish that was risen on this day, and it contained no food, although minnows were in shoals in its vicinity. The 'rising' qualities of the trout could be greatly improved by the introduction of suitable aquatic insects, but frequent emptying of the reservoirs would interfere with such a plan.

"On one day, when land-insects were very active, six trout averaging $\frac{3}{4}$ lb. each, were examined. All contained practically similar food, and the whole digestive tract was crammed with this.

"The food-contents of one were examined in detail and the constituent species arranged for exhibition. They were as follows:—COLEOPTERA—46 species of beetles. LEPIDOPTERA—wing of Noctuid moth and a whole Tincid. NEUROPTERA—small caddis-fly and cases of two species; also head of dragon-fly nymph. RHYNCHOTA—large Pentatomid bug and 3 species

of Homoptera (Jassidae). DIPTERA—one small fly only, but numerous pupae and larvae of *Chironomus*. HYMENOPTERA—*Vespa vulgaris*, 6 species of ants (which were swarming), and a small black sawfly at present undetermined. ORTHOPTERA—a grasshopper.

"Many stones, possibly swallowed with caddis grubs, several seeds, and two feathers, these no doubt mistaken for flies in the ripples on the water, were also found.

"The beetles chiefly represented were the Carabidae with 10 species; Staphylinidae—9 species; Curculionidae—6 species.

"In this particular trout by far the greater part of the whole food contents was made up of the Curculionid beetle, *Sitones hispidulus* and the flying ants; of both these, each of the six fish contained countless specimens. The largest insects—wasps, Pentatomid bugs, grasshoppers and dragon-fly nymphs—were generally more or less chewed up, the others mostly swallowed whole.

"The general absence of two-winged flies or Diptera was remarkable. If fish had been obtained at night or early in the morning probably more moths and a good many caddis-flies would have been found, but these are easily digested and soon disappear from the alimentary canal.

"On different days the food contents varied much in these trout. When ants were swarming there were days when this formed almost the whole food: on other days all the fish were crammed with *Aphodius contaminatus*.

"The most minute insects are taken, *e. g.* the 4 species of parasitic Hymenoptera, representing the Chalcididae (*Pteromalus*), Proctotrupidae (*Diapria*), Alysiidae and Cynipidae; also the very small gnats which sometimes cover the water after drifting into some sheltered position.

"In past years when I have occasionally been able to fish the reservoirs in the evening, the rise is sometimes entirely confined to that time of day and to the most minute gnats. Although the water may be everywhere 'boiling' with trout, it is then often impossible to get a rise at any artificial fly.

"In spite of the uncertainty of the food-supply on any particular day all the trout caught were in fine condition, the average weight being ¾ lb., and the largest fish (mentioned

on p. lxxv) was only 17½ inches long, a most perfect specimen of the Lochleven breed.

"It is evident that neither size, odour, colour, nor sting of insects affect these reservoir trout, but they are indiscriminate feeders. In spite of this it is well known that on hot summer days such as those on which they were taken, they are very difficult to catch. This is to be attributed to the fact that at such times no gut can be found sufficiently fine to be invisible to them and yet strong enough to hold the fish.

"I have seen a loose, floating, artificial fly taken at once, when the same fly with the finest gut attached was either altogether refused or produced only a 'short' rise, the fly not being taken in the mouth."

Mr. Mosely expressed surprise that such a large amount of surface food had been taken, and said that the exhibit suggested that the pattern of fly used in fishing for trout would seem to be of less importance than is generally supposed.

Papers.

The following papers were read :—

"On *Boreus hyemalis*," by Mr. C. L. Withycombe.

"Some apparently new S. African Genera and Species of the family Pyralidae," by Mr. A. T. J. Janse.

"The African Species of the Genus *Neptis* Fab.," by Dr. H. Eltringham, M.A., F.Z.S.

"The number of joints in the antennae of Haliplidae and Paussidae (Coleoptera)," by Mr. T. G. Sloane.

"Observations on the Structure of some Homoneura, including the Diagnosis of two new families of Lepidoptera," by Dr. A. Jefferis Turner.

Mr. A. T. J. Janse gave an account, illustrated with lantern slides, of methods of collecting insects when travelling in South Africa.

Wednesday, October 19th, 1921.

The Rt. Hon. Lord Rothschild, D.Sc., M.A., F.R.S., etc., President, in the Chair.

Gift to the Society.

The presentation by Mr. H. Donisthorpe of a drawing of Mr. H. W. Bates to the Society was announced, and a special vote of thanks was passed to the donor.

Election of Fellows.

The following were elected Fellows of the Society:—Messrs. H. I. Wilson, O.B.E., M.A., F.Z.S., 139, Bishop's Mansions, S.W. 6; Alexander John Nicholson, University of Sydney, New South Wales; F. N. Chasen, M.B.O.U., Assistant Curator, Raffles Museum, Singapore; Baron J. Bouck, Springhill, South Godstone, Surrey, and Perry A. Glick, 903, West Illinois, Urbana, Ill.

Exhibits.

Lepidoptera from Dutch New Guinea.—Mr. G. Talbot exhibited on behalf of Mr. J. J. Joicey the following new and rare Lepidoptera collected by Messrs. Pratt in the Weyland Mountains, Dutch New Guinea:—Ten species of *Delias* new to science; also new races of *D. ligata, D. isocharis, D. gabia, D. ladas, D. nais, D. aroae* and *D. albertesi;* examples of *D. discus, catisa, microsticha, enniana, kapaura, omissa, dorothea, ennia angustina, mysis lara, geraldina emilia, phaeres,* and *neagra;* a series of *Delias aruna* Bdv., showing transitions in both sexes to the race *inferna* Butl.; *Delias persephone* Stgr., with the mimetic *Huphina abnormis* Wall.; a new species of *Tellervo* with yellowish band on the hind-wing; the Satyrid genus *Pieridopsis* represented by *P. virgo* R. & J., and two new species all taken in the same district; *Elymnias paradoxa* Smith, together with the similarly patterned *Prothoe australis* and *Papilio thule;* a new species of *Practaxila,* the ♂ with yellow-brown bands and the ♀ with white bands, together with the similarly coloured Agaristid, *Immetalia*

longipalpis Kirby, in which the ♂ resembles the ♀ of the Erycinid and the ♀ the ♂; also a similarly coloured Zygaenid (a new species of *Eusphalera*), and two Geometrids.

The female of the wonderful Lycaenid, *Lehera grandis* R. & J.; a species of *Cyaniris* probably new; a gynandromorph of *Danaida schenki periphas* Fruh.; a very dark aberration of the female of *Troides helena papuana* Wall., with fore-wing as in the male, and hind-wing with ocelli effaced, and wider black margin; and a darker specimen than usual of *Troides poseidon* ♀ f. *kirschi* Ob.

The exhibitor stated that descriptions of the new forms shown will be published in the Bulletin of the Hill Museum.

Mr. Talbot also read a letter from Mr. Pratt describing the country from which the specimens came.

New African Papilios.—Mr. F. Le Cerf, on behalf of Mr. J. J. Joicey, exhibited the following new forms of African *Papilio*:—

Papilio dardanus meriones Feld. ab. nov. ♂.

Ailes inférieures avec une très large bande noire continue, échancrée entre les nervures 5 et 6, et légèrement saupoudrée d'écailles jaunes à la place de la bande claire submarginale. Queues entièrement noires.

1 ♂, Madagascar.

Cette aberration individuelle paraît être un retour atavique vers une forme ancestrale dont le plus proche représentant actuel est *P. dardanus-humbloti* Obt., de la Grande Comore.

Papilio dardanus-dardanus Brown.

Parmi les femelles si variables de cette espèce deux specimens sont particulièrement intéressants en ce qu'ils constituent les premiers exemples connus d'individus de la race type, ayant pris la livrée des femelles de la race *cenea* Stoll (= *tibullus* Kirby) volant dans la même région—Uganda où la dernière citée atteint, d'ailleurs sa limite septentrionale. Chez l'une de ces deux femelles les ailes inférieures sont semblables à celles de la forme *niobe* Auriv.; par contre les ailes supérieures ont déjà, avec des restes du dessin des ♀♀ occidentales, les taches discales et subapicales caractéristiques des ♀♀ *cenea* Stoll, mais toutes ces taches sont rouge fauve.

La seconde forme, beaucoup plus remarquable, est une copie presque exacte de la ♀ *cenea* à taches blanches (= *acene* Suff.). Comme la précédente elle a été capturée dans l'Uganda avec des mâles *dardanus-dardanus* typiques.

Papilio constantinus Ward nov. var.

Les specimens récoltés entre 6500–9000′ dans l'Escarpment (B.E.A.), diffèrent de tous ceux des régions plus basses et répandus du Mozambique au N.E. du Lac Rodolphe par une taille plus petite, les ailes plus larges, l'extension des dessins jaunes, particulièrement de la bande médiane et des points submarginaux des deux pairs d'ailes, le corps et la base des ailes roussâtres, le dessous plus clair.

C'est une variation de même sens que celle affectant *P. dardanus-polytrophus* R. & J., localisé également dans cette région élevée.

Papilio charopus Westw. n. var.

Comme seulement de l'Afrique occidentale (Ashanti à Cameroun) ce *Papilio* étend son habitat beaucoup plus à l'Est, jusqu'aux limites orientales du Congo belge.

2 ♂♂ de la Vallée du Semliki appartiennent à une race locale très distincte, plus petite que la forme typique, avec les bandes vertes du dessus plus larges, tous les dessins du dessous jaunes au lieu de bleu lilas, et les taches discales jaunes des ailes supérieures plus étroites et plus nettes.

Papilio nireus L. ab. nov.

Un specimen d'Aguapin (W. Africa) présente une remarquable convergence vers *P. lyaeus* Dbl., f. *pseudonireus* Feld., d'Abyssinie, en ce que la bande verte médiane des ailes supérieures est extrêmement réduite, incomplète et maculaire; mais tandis que chez *lyaeus-pseudonireus* la réduction s'opère du bord postérieur vers la côte, dans la nouvelle aberration du " Hill Mus." elle procède au sens inverse, c'est-à-dire de la côte vers le bord interne.

Papilio grose-smithi Roths.

Lord Rothschild a récemment donné ce nom à un Papilio de Madagascar intermédiaire entre *Papilio morondavana*

Gr.-Sm., et *P. erithonioides* Gr.-Sm., tous de Madagascar. Il existe de *grose-smithi* une variété constituant sans doute une race locale, caractérisée par la réduction des dessins jaunes, l'absence de fauve à l'œil costal des ailes inférieures chez le mâle, la forme des points submarginaux des ailes supérieures, etc.

2 ♂ ♂ au Hill Mus., 1 ♀ au Museum de Paris.

Comments on this exhibit were made by the PRESIDENT and Prof. POULTON.

SERIES OF BRITISH LEPIDOPTERA.—Mr. W. G. SHELDON exhibited :—

(1) A series of *Peronea cristana* Fab., of over 1300 specimens, including the specimens contained in the series of the late Sydney Webb. This series contains examples of all the 72 named forms, and the type specimens of 38 of them.

(2) A series of *Oxigrapha literana* L., of about 250 specimens, including examples of most of the named forms, and the type specimens of six of them. This series contains the material used by the exhibitor in his paper on this species in the current volume of the Entomologist.

A FORM OF HEODES PHLAEAS L., IN S.W. UGANDA.—Prof. POULTON exhibited the eleven specimens of *H. phlaeas* referred to by Dr. G. D. H. Carpenter in a letter written from Kabale, S.W. Uganda (30° E., 1° 15′ S. : 6000 ft.) on January 11, 1916 :—" I've also seen a typical ' Copper,' which I've never met before in Africa " (Proc. Ent. Soc., 1916, p. cxv). On January 29 Dr. Carpenter caught a specimen on the shore of Lake Bunyoni, W. Kabale, and ten others, between January 23 and February 23, at Kigezi (29° 45′ E., 1° 15′ S. : 6000 ft.). Only two females were taken, both on February 23, a male being captured on the same day. The right hind-wing of the Kabale male was shorn, probably by an enemy.

In a very uncritical spirit I assumed that the " Coppers " were *H. abboti* Holl., and recorded this erroneous determination on the above-quoted page. When, however, Canon St. Aubyn Rogers saw the specimens, during the past summer, he at once pointed out that they were very different from the *abboti* with which he was so familiar on Kilimanjaro,

Londiani, and several localities near Nairobi. Comparison with *H. phlaeas* L., at once showed that Dr. Carpenter's series was, as regards upper surface pattern, indistinguishable from this species. Even the minute blue spots which are such a well-known feature on the hind-wing of many examples of *phlaeas* were present in varying degrees of development on all the Uganda individuals except a single male. The red marginal band of the hind-wing was broader than in *phlaeas* generally, but a band as broad is present in many of the specimens from the Canaries, Morocco, Algeria, and Palestine, and in a single female in the British Museum, from Harrar, Abyssinia, near the British Somaliland border. It bears the date January 3, 1902.

The under surface of all the Uganda specimens differs from *phlaeas* of the Northern Belt, etc., in its warm reddish tint, like that of *abboti*, but darker. The internervular dark marks inside the red band of the hind-wing below are larger and less defined than in *phlaeas*, and they are in some individuals prolonged inwards as wedge-shaped markings.

Examples of the Uganda *phlaeas* and of *abboti* were sent to Dr. T. A. Chapman, F.R.S., who has kindly examined them and reports as follows :—

" The appendages of *Heodes phlaeas* (Kigezi) and *abboti* (copper hind-wing : Kilimanjaro) seem to be quite identical; they differ from normal Northern examples of *phlaeas* in being of rather smaller size. This is most noticeable in the aedoeagus, which is 2·0 to 2·1 mm. long in Northern *phlaeas* and 1·63 to 1·75 in the African forms. There is a good deal of variation in its length in Northern *phlaeas*, but it is never appreciably below 2·0 mm. The length of the clasps is also less in the Africans, but the difference is not so great, inasmuch as some Northern ones are as short as some African. The structure of both valves and aedoeagus seems to be identical in the two. The valves vary in both, in the precise outline and in the development of the spines on the ventral part of the distal margin. In both, at the dorsal end of the terminal (distal) margin, there is a division into two layers, one smooth, the other toothed. This is not easily seen except when the toothed layer (inner) happens, by some accident in mount-

ing the preparation, to be folded over. This difficulty must be kept in mind, when I report not having seen this fold in other 'Coppers.' It no doubt represents (as a remnant) the distinction between the 'valve' and 'harpe' which are here nearly completely combined to form the clasp.

"There is a structural difference in the penis sheath, a development of which I take the triangular pair of plates, interior to the clasps, to be. These are hardly identical in any two specimens, and the form that is characteristic of the African specimens and is very much the same in all those examined, is also found in the Northern races, in which it varies from the very rounded ends of the African form to one in which these are almost sharply pointed. This difference decidedly exists, but is sometimes exaggerated by some difference in mounting the specimens.

"It is possible to regard the difference in size, and the greater constancy to one outline in the penis sheath, as specific differences. For my own part, I regard them as items of geographical variation, still far short of implying specific distinction (though of course tending in that direction), especially since no other definite specific characters are reported.

"I may say that I regard *hypophlaeas* (Lapland and N. America) as specifically identical with *phlaeas*. The appendages don't differ at all, and, as regards colour and markings, specimens from India and Japan differ much more from *phlaeas* than *hypophlaeas* does. On the other hand I have just looked over the appendages of thirteen species of 'Coppers,' and there are no two of them that could by any chance be regarded as identical, as all the *phlaeas* I have looked at, seem to be. *H. orus* (S. Africa) is very different from *phlaeas* and *abboti*.

"I should think Uganda and British *phlaeas* would pair and probably prove fertile, but a little acclimatisation of one or other would make it more likely. It is also possible to suppose that, though they are essentially one species, by prolonged geographical segregation the two forms have become asyngamic, though, as I suggest above, this might readily yield to a little acclimatisation or domestication.

"The African forms—*phlaeas*-like and *abboti*—do differ from all the others in the very warm ruddy colour of the underside, markings not differing.

"The Japanese examples differ probably equally importantly in the very strong wide border of red to the hind-wings below. Some Indian specimens approach this.

"As there is some little difference in the ruddy underside colour in the few specimens I have, it would be of interest to look through your long series and see whether some have a more palaearctic tint.*

"*H. abboti* is very red beneath, but I think your least red Uganda *phlaeas* is not so very much redder than my reddest Britisher. I may note that the ruddy shade, when it appears in British examples, is most marked on emergence and tends to fade. It is of course a long way behind *abboti*.

"My own view is that they are all one species, but it is quite a question of personal idiosyncracy, depending perhaps on whether one has worked with species having vars. long recognised as species, or with species so similar as to be easily confounded. I don't suppose it can be settled till the two forms have been bred side by side and crossings attempted."

Dr. Chapman's report leads to the interesting conclusion that there is a definite, though small, structural difference between the Northern and the Uganda *phlaeas*, although there is no constant colour difference except in the tint of the under surface; while, on the other hand, there is no structural difference between *abboti* and the Uganda *phlaeas*, although there is a marked colour difference in the red hind-wing of the former. But this contrast only supplies another striking illustration of the fact that variations in colour and in structure are independent of each other.

Although *abboti* appears, at first sight, to be so different from *phlaeas*, the effect is due to a very slight change in the upper surface of the hind-wing—the intensification into a bright coppery red of the similar but much fainter iridescence which can be commonly seen, brightest towards the base of the

* The Uganda series is reddish throughout and presents none of the marked variation in tint that is so noticeable in *phlaeas* from other localities. *H. abboti* is also constant in its somewhat less dark reddish tint.—E. B. P.

wing, on the black ground-colour of *phlaeas*, and is distinct in the Uganda forms.* Two *abboti* collected November 20–21, 1910, by Dr. S. A. Neave on the slopes of Mt. Rungwe (5–6000 ft.), near New Langenburg, S.W. Tanganyika Territory, are transitional in their incomplete attainment of the characteristic brilliant red.

Other differences between the hind-wings are only apparent. The zigzag row of black discal spots and the prominent, black, disco-cellular mark which seem to distinguish the hind-wing upper surface of *abboti* from that of *phlaeas* are also present in the latter form and can be easily made out, by their intenser blackness, upon the dusky surface of the wing. Even the pale blue spots commonly present just inside the red marginal band of *phlaeas* can be detected, white against the red background, in some specimens of *abboti*. Furthermore, Dr. Eltringham, examining the spots with the binocular microscope, found blue scales among the white, and agreed with me that there was no doubt about the markings being homologous.

In addition to Dr. Carpenter's specimens, Mr. Talbot informs me that the Hill Museum, Witley, possesses the following examples collected in 1919 by Mr. T. A. Barns :— Kissenji, Kivu, Sept. & Oct.—2 ♂ 1 ♀; Lake Tshohoa, Ruanda Distr., Aug.—1 ♂; Upper Akanjaru Valley, Urundi Distr., July & Aug.—1 ♂ 1 ♀.

The small structural differences described by Dr. Chapman, together with the tint of the hind-wing below, make it clear that the two African forms are geographical races of the Northern *phlaeas*. In Africa itself, the difference in distribution and in the colour of the hind-wing above enables us to distinguish the following subspecies :—

(1) *Heodes phlaeas abboti* Holl., common at an elevation of about 6000 ft. and higher, in Kenya Colony and Tanganyika Territory.

* A British example captured in the summer of 1921, and shown at the meeting of the S. Lond. Ent. Soc., Nov. 24, 1921, by Mr. L. W. Newman, approaches *abboti* far more closely than any of Dr. Carpenter's Uganda specimens. The red iridescence on the hind-wing upper surface was strong enough to render the black spots markedly conspicuous.—E. B. P.

(2) *Hecodes phlaeas ethiopica*, subsp. n., from about 6000 ft., in the extreme S.W. of Uganda and also further south on the high country near Lake Kivu and between it and the northern end of Tanganyika. It will probably be found to extend to all similar elevations bordering the Western Rift Valley.

It is possible that this latter subspecies may be identical with *pseudophlaeas* Lucas (1866), an Abyssinian form to which Aurivillius appends the note—"vix descripta. ? = *phlaeas*, L., var. geogr." But the structural characters ought to be investigated before concluding that this is the same as the Uganda form. The single Abyssinian example in the British Museum does not greatly help, because it is a female with an under surface too worn for the determination of the original tint. A series of specimens from Abyssinia is much to be desired.

Larvae of rare British Beetles, etc.—Mr. Donisthorpe exhibited (1) a specimen of *Gymnetron squamicolle* Reitter, taken by himself at Glencar, Co. Kerry, on June 16, 1902, a species not previously recorded from the British Isles, and mentioned its geographical distribution, etc.

(2) *Cassida nebulosa* L., and its pupa, larval skin, etc., taken on *Chenopodium album* near Waterbeach, August 24, 1921. He said that the larva pupated on August 28, and a number of Chalcid parasites emerged in September from three holes in the dorsal surface of the larva; also another pupa of the same taken near Wokingham, September 6, 1920, thirteen specimens of the same Chalcid having emerged a week later from the dorsal surface.

(3) Larvae both dead and living of *Trinodes hirtus* F., taken under bark of oak and elm in spiders' webs in Richmond Park, July 28, 1921; also a perfect insect taken in the same locality on May 31, 1912. He also made some remarks on the habits of these larvae and the difficulty of rearing them.

A Scolytid new to Britain.—Mr. D. J. Atkinson exhibited examples of *Ips erosus* Woll., found breeding in the Forest of Dean in August 1921. He had taken this Scolytid in large numbers in felled Scots Pine in company with *Ips sexdentatus* Börn., a beetle sufficiently uncommon

as to be considered rare, but which seems to be spreading. *I. erosus* was found in all stages, and *I. sexdentatus* as pupae and adults. The exhibitor said that *I. erosus* is very similar in appearance to *I. laricis*, with which it is closely allied, and with which it is likely to be confused, and gave some details of the characters—especially the teeth on the apical declivity of the elytra—by which they may be distinguished. He also read the following notes on this beetle :—" *Ips erosus* is a polygamous species and constructs very clearly defined many-armed (usually 3 or 4) galleries, diverging in a longitudinal direction from a small central nuptial chamber. The larval galleries are given off at either side, more or less at right angles. The galleries, both adult and larval, are chiefly in the bark, but slightly score the sap wood.

" Eichoff gives the distribution of *I. erosus* as S. Europe, the Mediterranean Coast, N. Africa, and the Landes, France, and its chief host-tree as *Pinus maritima*. The fact that it is a Mediterranean species makes it doubly interesting that it should have arrived in this country and succeeded in establishing itself successfully. In this connection Dr. Munro tells me of a record in the summer of 1920 of *I. erosus* being taken in the timber of *P. maritima* on a ship from the Mediterranean lying in Cardiff Harbour. It would seem therefore that some of these specimens must have since found their way up the Bristol Channel to the Forest of Dean, where they have taken quite successfully to *Pinus sylvestris* in place of the normal *P. maritima*. This beetle seems worthy therefore of the attention of foresters throughout the country as a possible additional pest of the already sorely afflicted Scots Pine."

Paper.

The following paper was read :—

Prof. C. Alexander on " New or little-known Exotic Tipulidae (Diptera)."

Mr. A. T. J. Janse gave a further account of methods of collecting when travelling in South Africa, illustrated with lantern slides.

Wednesday, November 2nd, 1921.

The Rt. Hon. Lord Rothschild, M.A., F.R.S., etc., President, in the Chair.

Gift to the Society.

The presentation by the President of a rare copy of Scopoli's "Deliciae Florae et Faunicae" was announced, and a vote of thanks to him was carried with acclamation.

Election of Fellows.

The following were elected Fellows of the Society :—

Messrs. Norman E. Miller, Dar-es-Salaam, East Africa; Oliver Richardson Goodman, 210, Goswell Road, E.C. 1; K. P. U. U. Nair, M.A., Training College, Trivandrum; Frank Balfour-Brown, M.A., F.R.S.E., F.Z.S., Oaklands, Fenstanton, St. Ives, Hunts; E. Melville Du Porte, M.Sc., Ph.D., Macdonald College, Quebec, Canada; Oliver C. Cassel, D.F.C., N.D.A., West Hill, Ottery St. Mary, Devon; O. C. Ollenbach, Survey of India Dept., Dehra Dun, India; J. B. Corporaal, Pieter Bothstraat, 39, The Hague, Holland; Douglas Cator, 13, Westminster Mansions, Gt. Smith St., S.W. 1; Marco Pallis, Tatoi, Aigburth Drive, Liverpool; and Samuel Walker, 53, Micklegate Hill, York.

Exhibitions.

Butterflies from Sutherlandshire.—Mr. W. G. Sheldon exhibited :—

(1) A series of *Epinephele ianira* from Lochinver, Sutherlandshire, showing an approach to the South European form of that species, var. *hispulla* Hüb., one or two being almost identical with it. South of England examples and var. *hispulla* were also shown for comparison.

(2) *Pieris napi*, showing an approach to the Alpine and Boreal form var. *bryoniae* Och., from Inchnadamph, Sutherlandshire, with South of England, Lapland, and Alpine examples for comparison; also a specimen of *P. napi* from Lochinver only 14 miles away and practically agreeing with specimens from the South of England.

Remarks on the races of these butterflies were made by

the PRESIDENT, Commander WALKER, Mr. BETHUNE-BAKER and Mr. DURRANT.

Mr. G. T. BETHUNE-BAKER brought for exhibition a series of *Zygaena filipendulae chrysanthemi* from the neighbourhood of Birmingham.

A REMARKABLE NEW INSECT FROM KASHMIR.—Mr. F. W. EDWARDS said that the specimens exhibited were received on the 29th of October, 1921, through Mr. Martin E. Mosely, and were taken in Kashmir, at a height of 11,000 ft., by Mr. J. F. Mitchell, Director of Trout Culture.

Though they are probably to be regarded as representing a new family of Diptera, they show curious resemblances to the May-flies in certain respects, notably the entire absence of mouth-parts. The structure of the wing is altogether unlike that in any known Dipterous fly, and suggests that it is capable of being folded up like a fan. The collector had not supplied any information as to the insect's habits, and was doubtless unaware that he had taken specimens of more than usual interest, since he sent them merely as specimens of trout-food.

One specimen was shown in a glass cell, one of its wings having been removed and mounted dry for the microscope. The head and one wing of a second specimen were shown on another slide, and photographs of these were also shown.

GYNANDROMORPH OF A. BETULARIA.—Mr. L. W. NEWMAN exhibited :—

(1) A gynandromorphous example of *Amphidasis betularia* var. *doubledayaria*, the right side being ♂ and the left ♀. The specimen has the left hind-wing slightly peppered with white, the remaining three wings being typical of the form *doubledayaria*, and was bred from Sidcup larvae in June, 1918.

(2) A large Ichneumonid bred from *Sphinx ligustri*.

THE WARBLE-FLY OF THE REINDEER CAPTURED WITH ITS MODEL BOMBUS LAPPONICUS MURMANICUS SKORIKOF.—Prof. POULTON said that he ventured to show specimens exhibited by the captor, Dr. E. A. COCKAYNE, and described in Proc. Ent. Soc., 1919, p. v, because they proved that the stingless ♂ *Bombus* acts as a model as well as the ♀ and ☿. One female *Oedemagena* (*Hypoderma*) *tarandi* L., was taken

close to a male bee, Aug. 1, 1917, Yukanski Harbour, while two other female flies were taken close to 1 ♀, 1 ☿, and 2 ♂, Aug. 12, in the same locality. On each date the captures were effected by Dr. Cockayne within an hour. The reddish-brown abdomen had faded to yellowish in the ♀ and ☿, but in the three flies, was richly coloured like the fresher ♂♂ of *Bombus*.

The mimicry of male Lepidoptera by female and of female by male.—Prof. Poulton said that, on thinking over Mr. Talbot's exhibit at the last meeting of a male Agaristid moth mimicked by a female butterfly, and its female by the male of the same butterfly, it had occurred to him that the males and females of this day-flying moth are probably on the wing together and do not exhibit sex-differences in flight and habits like so many butterflies. If this were so, there would be no advantage in the sexes mimicking each other and the result would probably entirely depend upon the colours and patterns of the sexes in the non-mimetic ancestor of the mimic.

When the female of a sexually dimorphic butterfly mimicked one sex of a sexually dimorphic model, it was not uncommon for the male rather than the female to be resembled. Well-known and striking examples were *Papilio dardanus* Brown, ♀ f. *planemoides* Trim., and the female of *Acraea alciope* Hew., both mimicking the male of *Planema macarista* E. M. Sh. The explanation is probably to be found in the fact that the male *Planema* is more commonly seen than the female and therefore more effective as a model. But when both sexes of such sexually dimorphic butterflies are mimics, he believed that the sexes always kept true to those of the model, and that this is to be explained, as suggested above, by the likeness between the habits of males and females respectively, rendering the female a better model for the female and the male for the male.

The oviposition of the Mylabrid beetle M. oculata Thunb., var. tricolor Gerst.—Prof. Poulton read the following note, recording Mr. Arthur Loveridge's observations on this beetle, kindly determined by Mr. K. G. Blair from the elytra of the specimen sent in the accompanying letter from Kilossa :—

"Sept. 27, 1921.—At Kilossa, Tanganyika Territory, on Dec. 4, 1920, I saw a *Mylabris* excavating a hole in a path, the ground being sandy but hard. The method was to bite into the ground all round until a little pile of loose sand was accumulated near the throat of the beetle. About every fifty seconds (average) this was dragged out by means of throat and first legs. Only these legs were in the hole and were often bent, the beetle being on its 'knees' as it were. The second legs straddled out very uncomfortably on either side of the hole, while the third legs were busily engaged in pushing freshly brought-up soil further back: they worked very mechanically.

"At 10.30 a.m. the sun was shining fiercely. The earth was only heaped on one side of the hole, forming a mound two inches long and perhaps three-quarters of an inch at its widest; in height half an inch. The entrance to a nest of small ants was only 15 inches away. The abdomen of the *Mylabris* was much distended with eggs. It showed two small red spots near the termination of the elytra and these, when the beetle dug deeper into the hole, had the effect of making the abdomen look face-like.

"At 10.36 the beetle was in the hole up to the anterior edge of the elytral cream spots. By 11 a.m. the hole was increased in depth so that the posterior edge of these spots was level with the ground surface. [Mr. Blair estimated from these data that the hole was about an inch deep.] The sand-heap now formed a semicircle round the hole and much nearer to its edge. The hole was not absolutely vertical. At 11.5 the *Mylabris* backed into the hole with its first legs resting on the rim of the excavation, and bent inwards like the arms of a man might be in a similar situation. At 11.10 the beetle rose slightly in the hole and now rested its middle legs also on the marginal rim.

"At 11.20 the beetle came out of its hole and commenced energetically to kick earth backwards into it as a mammal might do, but with the advantage of an additional pair of legs. The hind pair were engaged in ramming the earth well in. After the hole was filled the beetle continued to shoot earth towards it, so that a little heap soon accumulated on

the site. The beetle then walked about for a little time, demolishing any small accumulation of sand, rather unnecessarily so it seemed. Whilst so occupied and without any warning it very suddenly spread its wings and would have flown off had it not been captured. An examination of the nest showed it to contain 138 cream-coloured eggs $\frac{1}{3}$* of an inch in length.—A. L."

Forms of Papilio dardanus Brown, from Nairobi and the higher land to the West.—The Rev. K. St. A. Rogers exhibited examples of the female forms of *Papilio dardanus* Brown, captured recently at Nairobi, together with similar forms from the higher ground between Nairobi and the Rift Valley, kindly lent by Prof. E. B. Poulton for comparison.

The Nairobi forms belong to the subspecies *tibullus* Kirby, and those from the higher ground to *polytrophus* Jord. The males call for little remark. They are distinctly less heavily marked than those from the East Coast and intergrade towards the much less heavily marked males of *polytrophus*. They undoubtedly suggest that the *tibullus* form has been modified by interbreeding with the *polytrophus* form, but on the whole they are quite as large as the Coast forms, whereas the *polytrophus* forms are appreciably smaller.

The female forms shown consist of (1) *trimeni* Poulton, one specimen particularly exhibiting a great reduction of the black markings. In this specimen the markings of the fore-wing are practically identical with those of the male with the exception of the well-marked diagonal black bar and the pale spots in the hind-marginal black band.

(2) A specimen intermediate towards the form *hippocoon* F. The markings are identical with those of *hippocoon*, but the pale colour is that of *trimeni*, but a little more ochreous.

(3) *hippocoon* F. The East Coast form with large white patch in the hind-wing. This is the most abundant form at the lower levels.

(4) *lamborni* Poulton. A primitive *trophonius* with the pale markings rather more extensive and yellow instead of white. One specimen shows much more primitive characters in the fore-wing, the black diagonal band being practically

* The typescript fraction is not distinct. It may be $\frac{1}{8}$.—E. B. P.

obsolete, and in another specimen the basal part of the cell is for the most part yellow.

(5) *mixta* Auriv. A richly coloured form linking together *planemoides* Trim., *leighi* Poult., and *trophonius* Westwood.

(6) *dorippoides* Trim. This has been fully described by Roland Trimen.

(7) *cenea* Stoll. Forms with the pale colour of *trimeni*.

(8) *cenea*. Forms both with white and palè ochreous spots on the fore-wing.

Besides these forms *planemoides* is known to occur in Nairobi, though it is not available for exhibition. All the ♀♀ as well as the ♂♂ are larger than those from the higher ground.

The great features of the species at Nairobi are—(1) the large number of different female forms; (2) the tendency of all the forms to exhibit primitive features, culminating in the form *trimeni;* (3) the frequency of the occurrence of intermediate forms for the most part with some primitive characteristics.

All these features are developed to a greater degree in the subsp. *polytrophus* and are probably due to interbreeding with it. The forms from the higher levels are slightly more primitive, especially in the possession of rudimentary tails.

Mimacraea marshalli Trim., and its form dohertyi Roths.—The Rev. K. St. Aubyn Rogers also exhibited *Mimacraea marshalli dohertyi* taken at Nairobi in October 1920, together with typical *M. marshalli* from Rhodesia and Katanga, and a smallish example from Kavirondo, kindly lent by Prof. Poulton for comparison. He observed that *dohertyi* had been comparatively common in Nairobi and at certain places in the neighbourhood for two or three weeks of 1920.

With one exception, which was beautifully intermediate, not one of these numerous captures exhibited any definite approach to the type form; but a single specimen, also shown, captured on the high ground to the north of Mpapua, in Tanganyika Territory, is a decided intermediate, perhaps rather nearer *marshalli*. Transitional characters are seen in the orange-brown marking on the black apex of the fore-wing

and in the black border of the hind-wing being intermediate in width between *marshalli* and *dohertyi*.

The Nairobi *dohertyi* on the average are appreciably larger than those from the higher levels from which it was originally described; they are also somewhat richer in tint, though the earlier specimens may have faded to some extent.

The species is found generally in open park-like country with scattered trees. Its flight is not rapid, though hardly so leisurely as that of *Danaida chrysippus* L., or *Acraea encedon* L. It frequently settles on tree-trunks, from which it starts into flight somewhat suddenly and often evades the net in this way. Its appearance on the wing is decidedly brighter than that of *A. encedon*, and it appears somewhat more rosy on the wing.

Danaida chrysippus is quite common at Nairobi, but *A. encedon* is not generally abundant there. In both species the *dohertyi*-like form without the black and white tip to the fore-wing is predominant.

Papilio rex Oberth., from Nairobi.—The Rev. K. St. A. Rogers also exhibited a case of *Papilio rex* males and female from Nairobi, together with the model *Melinda formosa* Godm. These specimens, coming from the Eastern limit of its range, may be regarded as typical. The males show a fair amount of variation, particularly as regards the basal fulvous of the fore-wing. It may be noticed that specimens of the model, two males and one female, were taken at the same place and on the same day as the mimics in the case of three of the males, and these are the actual specimens exhibited.

The first male is quite typical and is an excellent mimic of the *Melinda*.

In the second male, which was captured on the same spot and within a few minutes of the *Melinda*, the basal fulvous on the fore-wing is much paler. As the specimen is fairly fresh it is improbable that this is due to fading. These were captured on Sept. 13, 1919.

The third male departs more from the typical pattern. The basal fulvous is almost obsolete, and there is a conspicuous sickle-shaped mark below the cell. It will be observed that

there is a remnant of the distal end of this marking in the female exhibited and a trace in the first male. It is probable that this marking, which can also be traced in some examples of *P. rex mimeticus* Roths., is a vestige of an ancestral non-mimetic pattern, and its presence suggests a black yellow-marked *Papilio* which only required to develop the brown basal fore-wing patch in order to become a mimic.

The flight of *Papilio rex* is somewhat slow and leisurely, though often lofty and sustained. The species is also decidedly slow in starting from rest. The male is to be found at damp spots near rivers, and both sexes frequent flowers.

It is remarkable that when settled on flowers the wings hang straight downwards, without any motion. All other species of *Papilio*, even mimetic species, when feeding on flowers, stand on tip-toe, so to speak, and constantly flutter their wings. This habit is so general that it is often possible to recognise a mimicking *Papilio* by it.

An Oriental Danaine butterfly brushing the brands on its hind-wings.—Mr. W. A. Lamborn communicated the following observation and exhibited the insect concerned:—

"Happening to look up from a microscope while at work in the Laboratory in Kuala Lampur, F.M.S., January 15, 1921, I saw a male Danaine butterfly, which Prof. Poulton has kindly determined as *Parantica agleoides* Moore, settle with wings expanded on a plant outside. I immediately went out to watch it and saw that the hind-wings were apposed for about the posterior third of their surface, and that the anal brushes were protruded, the abdomen being curved so as to bring them into line with the brands on the hind-wings. Over these the unexpanded brushes were passed at about the rate of twenty a minute. The operation went on so long—about five minutes—that I was able to send, first for a chair on which to stand so as to watch the insect more closely, and then for a net to secure it."

Mantispids bred from the egg-cocoon of a spider.—Mr. W. A. Lamborn exhibited four Mantispids which emerged, between 6th and 8th March, 1921, from as many little cocoons which he found at Kuala Lampur, early in that month, on

tearing open the egg-cocoon of a spider. These insects were determined by Mr. B. P. Uvarov as *Mantispa annulicornis* Gerst.

Butterflies from New Guinea and Peru.—Mr. G. Talbot exhibited on behalf of Mr. J. J. Joicey :—

(1) A red-banded Mimetic Combination consisting of *Papilio euterpinus* G. & S., ♂, *Papilio cacicus inca* R. & J., ♀, *Pereute cheops* Stgr., ♀, and *Adelpha lara* Hew.

The red-banded ♀ form of *inca* is different to the similarly coloured ♀ f. *zaddachi* Dew., and is strikingly like *euterpinus*. This combination exists in Peru, Colombia, Venezuela, and Ecuador.

(2) A new *Papilio* from Ecuador, allied to *cutorina* Stgr.

(3) *Troides lydius* Feld. A male with a remarkable coloration, of deep copper or morocco red. This specimen was given to Mr. C. Pratt in Amboina, and was stated to have come from the island of Morotai, north of Halmaheira.

(4) *Troides* from the Wangaar District, south of Geelvink Bay.—*T. paradisea* Stgr., ♀, which may not be different from the typical form, *T. meridionalis* Roths., ♀, known previously only from British New Guinea, and *T. tithonus misresiana* J. & N., ♀, apparently quite the same as the Arfak specimens.

A rare British Aphid.—Mr. Donisthorpe exhibited a specimen of the rare Aphid, *Stomaphis quercus* L., several specimens of which he had taken on the trunk of an oak tree attended by ants, *Acanthomyops* (*Dendrolasius*) *fuliginosus* Latr., at Woking on September 22 and October 7, 1921. This Aphid appears to be very scarce in Britain, the only other published record being from Dulwich, where it was taken by Walker many years ago.

Mr. A. T. J. Janse concluded his account of methods of collecting while travelling in South Africa, illustrated with lantern slides.

Wednesday, November 16th, 1921.

The Rt. Hon. Lord Rothschild, M.A., F.R.S., etc., President, in the Chair.

The Secretary announced that the Council had nominated the following Officers and Council for 1922 :—

Officers.

President.	The Rt. Hon. Lord Rothschild, M.A., F.R.S., etc.
Treasurer.	W. G. Sheldon, F.Z.S.
Secretaries.	S. A. Neave, M.A., D.Sc., F.Z.S. H. Eltringham, M.A., D.Sc., F.Z.S.
Librarian.	H. J. Turner.

Council.

Robert Adkin, H. E. Andrewes, Ernest C. Bedwell, James E. Collin, F.Z.S., J. Davidson, D.Sc., F.L.S., J. J. Joicey, F.L.S., F.Z.S., F.R.G.S., etc., Frederick Laing, William G. F. Nelson, Prof. E. B. Poulton, M.A., D.Sc., F.R.S., etc., Norman Denbigh Riley, H. Rowland-Brown, M.A., J. Waterston, B.D., D.Sc.

The question of holding an informal meeting was put to the meeting, and it was decided to hold one on January 4th, 1922, from 5.30–7.30 p.m.

The Secretary read a letter from the Secretary of the Board of Applied Pestology announcing the inaugural meeting of the Board, and asking Fellows who wished to attend to apply to him for tickets.

Exhibits.

A new Ithomiine from Trinidad.—Mr. W. J. Kaye exhibited a new race of the Ithomiine butterfly *Dircenna lenea* from Trinidad, together with a series of the typical form from the Potaro district of British Guiana. He pointed out that the new race was markedly different, being altogether more suffused with yellow. In addition, the band of the

hind-wing was nearly double the width and the discal black band of the fore-wing broad and heavy, contrasting with a narrow and sometimes a total absence of the band in the typical form. For this Trinidad race he proposed the name *siparia* from the locality where it was taken. In Trinidad it was found that the area over which this species flew was exceptionally circumscribed, viz. a narrow forest path some 30 or 40 yards in length. In company with it were *Ceratinia euclea* and *Mechanitis polymnia veritabilis*, while 150 yards away *Melinaea tachypetis* was found inside the forest, but not flying along the path. In the case of the *Mechanitis*, which was in closest association, the black discal band is like the *Dircenna* in being heavy, while in the *Mechanitis* from Guiana (true *polymnia*) the band is broken up and reduced to small spots.

The Eggs of Bed-bugs.—Mr. A. W. Bacot brought for exhibition some remarkable enlarged microphotographs of the eggs of *Cimex rotundatus* and *C. lectularius*, clearly showing the distinctions between the two species in this stage. The exhibit gave rise to some discussion, in which the President and Mr. Durrant took part.

Lepidoptera from West Sutherlandshire.—Mr. W. G. Sheldon exhibited six examples of *Hydriomena furcata*, sallow-fed specimens, the only ones bred, all different forms; a series of bred *Bombycia viminalis*; a varied series of *Xylophasia rurea*, including the type form and also abs. *ochrea*, *flavo-rufa*, *alopecurus*, and *nigro-rubida*; *Coremia ferrugata*, ab. *spadiciara*; *Hipparchia semele* race *scota*, with southern examples for comparison; *Aglais urticae*, bred examples, with deep fulvous coloration and very pronounced blue marginal spotting, and southern examples for comparison; *Camptogramma bilineata*, ab. *hibernica*; a varied series of *Polyommatus icarus*, with very blue females, the blue of both males and females being pronouncedly *thetis*-coloured; *Eupithecia pulchellata*, ab. *hebudium*, *Cnephasia penziana*; *Sericoris cespitana*, *S. littoralis*, and *Coccyx distinctana*.

Pyrameis atalanta with larval head.—Dr. A. E. Cockayne exhibited an example of *Pyrameis atalanta* with the larval head, bred from a larva found at Alton Barnes, Wilts,

in August 1920. Dr. Eltringham expressed the opinion that such an individual would be unable to direct its flight.

Fluorescence as evidence for the evolution of the pigments of mimetic females from those of their non-mimetic males.—Prof. Poulton said that Dr. Cockayne had kindly helped him to examine for fluorescence the two drawers of the Nairobi forms of *Papilio dardanus* Brown, shown by Canon St. A. Rogers at the last meeting. The pale yellow of the males was brilliantly fluorescent, and that of the *trimeni* and *lamborni* females, from the high Kikuyu Escarpment and also from the lower elevation of Nairobi, was shown by its fluorescence to be the same pigment. One Nairobi *lamborni* was extremely brilliant, and, in all of them, the submarginal yellow spots were especially bright. The curious Nairobi specimen labelled "*hippocoon* with colour of *trimeni*, but darkened," when examined, confirmed this description by exhibiting an obscured fluorescence. Nearly the same form from New Moschi (F. C. Selous), in the British Museum, differed in having a somewhat darker F.W. and paler H.W. yellow pigment—the latter strongly fluorescent. Of the three primitive, yellow-marked *cenea* from the high escarpment, two were strongly fluorescent, but not one of the three from Nairobi. With fluorescence as a guide, it was clear that the yellow pigment of these latter is a little darker than the others, and that the brilliant *lamborni* has the palest yellow.

It was of much interest to find the primitive fluorescent yellow retained on these escarpment *cenea*, but lost at Nairobi. Although, to the eye, so small a change had taken place, it was evident that the three examples from the lower level were a definite step further towards the fully mimetic form. It was also interesting that the primitive yellow—whether replaced by white in *hippocoon* or a darker shade in *cenea*, *trophonius*, etc.—was fundamentally changed and ceased to be fluorescent.

Dr. Cockayne had also called his attention to *Papilio polytes* L., in which the discal yellow band of the male H.W. was, with the exception of the inner marginal spot (and occasionally two spots), brilliantly fluorescent. In the male-like females, on the other hand, two inner-marginal spots

and occasionally three were non-fluorescent. From the band of these females we pass to the shorter, broader, yellow band or patch of the *aristolochiae*-like females—nearly always non-fluorescent but shown by occasional fluorescent individuals to have been derived from the only fluorescent male pigment. For it should be added that the marginal yellow F.W. spots of the male never fluoresced.

A Dipteron and its Parasite in Ants' Nests.—Mr. Donisthorpe exhibited specimens of the Chalcid *Spalangia erythromera* Förster, together with its host *Phyllomyza lasiae* Collin, ms. (Diptera), and the ant *Acanthomyops* (*Dendrolasius*) *fuliginosus* Latr., in the nest of which these insects live. He pointed out that he had discovered the *Spalangia* first in Britain in a nest of the ant in question on May 6, 1906, at Wellington College, and had subsequently bred it in numbers in a bowl of refuse "carton" larvae and ants from the same nest that year. As the *Spalangia* is shining black like its host ant, and as the ants did not treat the parasite in an unfriendly manner, he concluded it was parasitic on the ant larvae. He had subsequently taken the insect in *fuliginosus* nests at Darenth Wood, Weybridge, Oxshott, and Woking. On Dec. 10, 1920, he had bred a specimen from refuse from a *fuliginosus* nest at Woking which did not contain any ants, or ant larvae; consequently he isolated a number of Dipterous pupae from this refuse in a small box, and from a pupa of *Phyllomyza lasiae* a specimen of the *Spalangia* had emerged on Feb. 21, 1921, thus fixing the host. Other specimens had been bred on April 10 and Sept. 30, from *Phyllomyza* pupae. The exhibitor remarked that the larvae of *Phyllomyza* were not parasitic, but lived free in the nests of ants, and that he had reared several species from the larva to the perfect insect in his observation nests.

A Fairy Tale.

Dr. Neave read the following translation from the German of a skit on modern systems of Zoological nomenclature by Dr. A. Reuss, the original of which was published in *Societas Entomologica* for November 1921, p. 42 :—

Once upon a time there was a land called Nomenclatoria.

The inhabitants of this land were interested in many animals, and to distinguish them from one another they gave every animal not only one but even two names. If in those days a collector caught a hawk moth, he could be almost certain that it belonged to the genus *Sphinx*. But soon the imperfections of this system became apparent. To the scientists of Nomenclatoria the genera appeared too large, so they were divided, and the divided ones subdivided, and continually changed, until after the lapse of several decades every second species had its own genus.

Then the specific names had to be changed and new ones erected, so as to describe all the newly discovered aberrations and variations. One scientist had the ingenious idea of transposing the syllables, *i. e.* for variations of *podalirius* he used the names *lidaporius* and *daporilius*. And all, who read this, marvelled at his brain.

Soon this was also inadequate and every animal received three names, and after another twenty years every species had six names in which the specific name of the original form was repeated five times. Ignorant people in Nomenclatoria grinned vacantly at this and made stupid remarks about the waste of time and space.

An old King of a neighbouring country, who had collected butterflies in his youth and prided himself on his knowledge, came on a visit. When viewing the State collections he stopped in front of a lime hawk moth and said proudly to his guide: "Aha, that is a *Sphinx tiliae*." The guide was startled to death, but quickly pulled himself together and answered: "It is entirely possible, Your Majesty, that this specimen was so called a hundred years ago. In the course of time the generic name after undergoing a more and more glorious perfection, and passing through *Smerinthus*, *Dilina*, *Mimas* and about ten other alterations, has to-day developed into *Caudex*. But this species that Your Majesty deigned to point out, is not the original form *Caudex tiliae*, but, owing to the band on the fore-wing, as Your Majesty notices, being 1/10 mm. narrower than that of the normal form as recognised by the State, is *Caudex tiliolus tilioides tiliabundus bundilatius lidabuntius*."

When the guide had spoken thus, the strange King demanded forthwith two national liqueurs. He then returned to his own country and forthwith issued a decree that no animal should be allowed to have more than two names. In consequence his kingdom was considered by the scientists of Nomenclatoria to be deplorably behind the times. During the last few years, however, there has been an astonishingly large number of cases of *Dementia praecox* reported from Nomenclatoria. Whether this has anything to do with the development of the names has not been determined.

Wednesday, December 7th, 1921.

The Rt. Hon. Lord Rothschild, M.A., F.R.S., etc., President, in the Chair.

Nominations for 1922.

The Secretary again read the list of nominations of Officers and Council for the ensuing year, and said that he had not received any alternative names.

Election of Fellows.

The following were elected Fellows of the Society :—Messrs. W. Bevan Whitney, B.Sc., A.M.Inst.C.E., Glen Doone, Gerrards Cross, Bucks; Edward Nevill Willmer, Trafford Hall, Nr. Chester; and John Glover Hugo Frew, M.Sc., 262, Church Rd., Yardley, Birmingham, and Rothamsted Experimental Station, Harpenden.

The Secretary expressed the hope that the informal meeting to be held on January 4th, 1922, between 5.30 and 7.30 p.m., would be well attended, and said that Dr. Cockayne had kindly offered to show the effects of fluorescence on butterflies, an exhibit that would be of great interest to Fellows.

Exhibits.

A new method of preserving insects.—Prof. Lefroy exhibited specimens of insects mounted on the method previously described by Dr. A. Moore (Journ. Trop. Med. and Hygiene, Nov. 15, 1919, pp. 205–206), and drew attention to the value of this method for teaching, for travellers in the tropics, and for general economic work. He explained that the insect is mounted fresh between two slips of celluloid with a ring of plasticine and thymol; the latter must be well incorporated in the plasticine at the rate of 1½ drachms to the pound. The specimens are well preserved, do not shrink, and retain their colour.

This method aroused considerable interest, and its advantages were discussed by the President, Mr. Bacot, Mr. Durrant, Mr. Balfour Browne and other Fellows.

The existence in Africa of a remarkable Papilio of the antimachus group.—Mr. G. Talbot said that when Mr. T. A. Barns was collecting Lepidoptera on the Lindi River in April 1920, he saw a remarkable butterfly, and he exhibited a coloured drawing of it which Mr. Barns had made. The insect appears to partake of the characters of both *Papilio zalmoxis* and of *P. antimachus*, but is unlikely to be a hybrid between them.

Since the publication of the note of this butterfly in the "Bulletin of the Hill Museum," some further information has come to hand which seems to confirm the evidence of Mr. Barns.

Monsieur F. Le Cerf, of the Paris Museum, has furnished the following account of an insect seen in French Guinea:—

"A sergeant Monceaux, who took part in the Franco-Liberian Mission for the delimitation of the Liberian-French Guinea frontier, made a collection of over 4000 butterflies. He described having seen in the district of the Upper Sassandra River a large butterfly which, at midday, was drinking from a pool of water on the road. The butterfly was opening and closing its wings, and Sergeant Monceaux got quite close to it before it flew away. The wings were very long and for the greater part of a brilliant blue.

"I showed the sergeant various butterflies, including *P. zalmoxis*, but these were not like the specimen seen. However, upon seeing *P. antimachus* he exclaimed: 'It is like that species but with much more brilliant blue, and larger.'"

Dr. W. A. Lamborn has written to say that he once saw a specimen of this great *Papilio* in S. Nigeria.

Mr. C. J. Grist records that a friend of his who was in Nigeria told him that he saw a large butterfly, which he could not catch, and his description tallied to a great extent with that of Mr. Barns', except that he said the fore-wings were all bright Cambridge blue and the hind-wings red with yellow markings.

We have recently come across the following note by Hewitson in the Ent. Mo. Mag., x, p. 122, 1873.—In the introduction to his description of some West African Lycaenidae he says that the collector, Mr. Rogers, "saw *P. antimachus* and another large butterfly, which, from his description, must be a magnificent species." No mention is made of what this was like and no further locality is given. May it not have been the species under discussion?

It is certain that a *Papilio* similar to the specimen drawn by Mr. Barns does exist in Africa, and the evidence points to its being distributed from Guinea to the Lindi River. It must be very rare, very wary, and very strong on the wing.

Prof. Poulton expressed the opinion that though this butterfly is probably very rare, it is not necessarily difficult to catch.

A Gynandromorph of Argynnis hyperbius castesti. —Mr. G. Talbot on behalf of Mr. J. J. Joicey also exhibited a gynandromorphous example of *Argynnis hyperbius castesti* Ob., from S. India, of which the right side is female, representing the *hyperbius* form with white subapical band. The left side has the fore-wing mostly male with the androconia present on vein 2. Traces of the female element occur in the presence of a portion of the white subapical band, of some of the white submarginal spots, and of some grey-blue scaling in cellules 3–5. The left hind-wing is female but darker than the right wing, and is a little smaller. On the underside the left fore-wing shows less trace of the female element than

on the upperside. The right fore-leg is female and the left is male, but with less hair than normally.

Specimen taken in May at Ootacamund.

This race is said by Fruhstorfer in Seitz, "Macrolep." ix, p. 515, to have the female like the male, but in the Hill Museum there is a series of both forms of female.

A SERIES OF AGLAIS URTICAE.—Mr. ROBERT ADKIN exhibited long series of *Aglais urticae* including many specimens from Scotland. Referring to Mr. Sheldon's exhibit at the last meeting, he pointed out three specimens were obtained from the same neighbourhood as his, and he agreed with him that that locality appeared to produce a form of rich ground-colour with brilliant blue marginal lunules. He thought, however, that the Scotch forms generally tended towards these characteristics, but that they were perhaps more marked in specimens from that immediate neighbourhood than in those from other parts of the country.

This exhibit gave rise to some discussion, in which Commander WALKER, Mr. BALFOUR BROWNE, Mr. SHELDON and others took part, on the comparative rarity of *A. urticae* in 1921 and on the relative abundance and apparent spread in the South of England of *Vanessa c-album*.

HELICONIUS FROM TRINIDAD.—Mr. W. J. KAYE exhibited *Heliconius melpomene euryades* and *H. erato hydara*, both from Trinidad, together with drawings of larvae and pupae of each. Both larvae and pupae differed widely from each other. *H. melpomene* was characterised by a small head and tapering first three segments. On all segments as well as the head there were subdorsal long spines with two or three short branches. *H. erato*, on the contrary, had a large head with fleshy protuberance and with non-tapering anterior segments. On the 2nd, 3rd, 5th, 10th, and 11th segments were subdorsal fleshy protuberances densely clothed with short spines. The pupa of *H. melpomene* was rather short with strongly projecting wing-cases, and thoroughly Nymphaline in appearance, with 6 abdominal silver spots. The pupa of *H. erato* was quite remarkably different, being very elongated and with two long fleshy protuberances to the head, and without any silver spotting.

A remarkable Erycinid from Trinidad, *Nymphidium maravalica*, was also shown, together with one of the small race of *Adelpha iphicla* from the same locality. It appeared from the facies of these two that the Erycinid mimicked the Nymphaline. The latter was exceedingly common, while the former was very rare. The whole scheme of colouring of the two was so similar that it was impossible not to suggest that the one was influenced by the other.

Black varieties of the Longicorn beetle, Grammoptera analis Pz., from the Oxford district.—Prof. Poulton exhibited on behalf of the captor, Mr. Joseph Collins, three (1918–20) entirely black forms of this species, and one (June, 1919) with black legs but the reddish yellow abdominal segments of the typical form. Both varieties were very uncommon as compared with the type, of which examples were also exhibited.

The third brood of Heodes phlaeas L., from the Newbury district in 1921.—Prof. Poulton gave an account of the following observations by Mr. A. H. Hamm, and exhibited the specimens referred to, as also those of Dr. Perkins taken in 1911 and 1912 :—

"The three series of *Heodes phlaeas* exhibited were all captured in the Newbury district, in early September of the present year. They are all of the third brood and show (with one or two exceptions) the brilliancy usually associated with the first brood. In spite of the prolonged drought, they equal, and, in some individuals, exceed in size those of the second brood.

"The first locality was a small damp meadow adjoining the tow-path of the canal, opposite Ham Mill, visited September 5, between 11.0 a.m. and 12.30 p.m. *H. phlaeas* was very abundant and the whole series of 30 males and 13 females captured on the flowers of fleabane (*Inula dysenterica*). Although the flowers of the devil's-bit scabious were in profusion, the only butterfly seen to visit them was *Vanessa urticae*, of which a very few examples of the second brood were on the wing.

"The second series, captured September 7, 2.30–4.0 p.m., was from Greenham Common—one of the highest and driest

places near Newbury. These were all taken on the flowers of a small patch of heath (*Erica*),—low and scanty after the burning of 1919. The *phlaeas* do not exhibit any appreciable difference in size or hue from those of the lower and damper locality, but are remarkable in the disproportion between the sexes—4 males to 34 females, perhaps to be accounted for by some of the families being all-female.

" The smallest series, 9 males and 13 females, were from a small patch of fleabane, on the tow-path of the canal, about 6 miles E. of Newbury, near Woolhampton, September 9, 2.45–3.30 p.m. These call for no special comment as they do not differ materially from the others.

" It was observed that *phlaeas*, immediately after alighting upon a flower, herbage, or the ground, invariably took up a definite position with its head turned directly away from the sun. Several individuals were seen to perform the ' eccentric ' movements with their hind-wings, in the same way that I have so often observed in *Cyaniris argiolus*. There are no striking varieties, but much minor variation. Some have the coppery hue very pronounced on the basal half of the hind-wing and a few are of the *coeruleo-punctata* form,—a variety supposed to occur more frequently in damp situations, but here as common in the high and dry locality as in the others.

" The three series were captured without selection, and thus are truly representative of their respective localities."

Prof. Poulton said that Mr. Hamm's series contrasted remarkably with those of the second brood collected by Dr. R. C. L. Perkins, F.R.S., at Cerne Abbas, Dorset, in the hot August of 1911, the latter being very dark as compared with a series taken in the same locality in the cold August of 1912 (Proc. Ent. Soc. Lond., 1912, p. cxxxviii). The " eccentric " movements had also been seen during the past season, in a small proportion of individuals at Newton Abbot, by Dr. Perkins, but not in the third brood (September).

Dr. Perkins had also informed Prof. Poulton that the 1921 April–May brood at Newton Abbot was normal, while the end–June and July brood was dark, much like that of Cerne Abbas in August, 1911. The slight rains at the end of July

and beginning of August were sufficient to make the fields green again and to change the third brood entirely, for not a single one of the September examples was dark, although the country had by this time become very dry.

Dr. T. A. Chapman wrote on October 4, that he was unaware of the "eccentric" movements of *phlaeas*.

Living Mantids.—Mr. R. Stenton exhibited some living Mantids, bred at the Ministry of Agriculture Pathological Laboratory, Harpenden. The egg-case had been taken by Mr. J. C. F. Fryer from a dwarf Japanese maple imported during the winter of 1920–1921. The eggs hatched in two batches, the first about June 9th and the second on June 16th. The young fed upon Aphids at first, then upon house flies, and later upon blow flies. They were kept in a cold greenhouse and attained the adult stage, a ♀ on 10th Oct. and a ♂ on 18th Sept., after which they would feed no more, except that the introduction of a ♂ to a ♀ resulted in the former being at once made a meal of. This was on Oct. 24th.

Papers.

The following papers were read :—

"Descriptions of South American Micro-Lepidoptera," by Mr. E. Meyrick, B.A., F.R.S., F.Z.S.

"Notes on Orthoptera in the British Museum. II. Group Calliptamini," by Mr. B. P. Uvarov, F.E.S.

Mr. C. Nicholson read some notes on Vespidae and on a remarkable nest of *Vespa vulgaris*, illustrated with lantern slides.

ANNUAL MEETING.

Wednesday, January 18th, 1922.

The Rt. Hon. Lord Rothschild, D.Sc., F.R.S., etc., in the Chair.

Dr. S. A. Neave, one of the Secretaries, read the following

Report of the Council.

The first year of the Society's occupation of its new home will always be a historic one, and it is therefore highly satisfactory that it is possible to report marked progress in all aspects of its activities.

The Society's financial position will be dealt with in the Treasurer's Report, which you will hear read shortly.

The losses in Fellows have been exceptionally heavy; these have been due to the death of 17 Fellows, the resignation of 20, and the removal of 6 for non-payment of subscriptions. In spite of this, our numbers have increased, 51 new Fellows having been elected. The Society now consists of 12 Honorary, 2 Special Life Fellows, and 664 Ordinary Fellows, making a total of 678, the largest number in its history. This result is a very gratifying one, and would appear fully to justify the policy of raising the subscription, which it will be remembered took effect from the beginning of the year under review.

The Transactions will consist of 604 pages, and will form the largest volume since 1913. This is due in some measure to a fall in the cost of printing, and it is much to be hoped that in the coming year it will be possible to return to at least the pre-war standard, not only of letterpress, but of illustrations. The volume for the year contains 15 papers by the following authors :—

H. E. Andrewes; G. J. Arrow, F.Z.S.; K. G. Blair; G. D. Hale Carpenter, D.M., F.Z.S., etc.; H. Donisthorpe, F.Z.S.; F. W. Edwards; H. Eltringham, M.A., D.Sc.;

the late C. O. Farquharson, M.A., B.Sc., and others; A. M. Lea; F. Muir; N. D. Riley, F.Z.S.; T. G. Sloane; A. J. Turner, M.D.; B. P. Uvarov; and C. L. Withycombe. Of these 5 refer to Coleoptera, 3 to Lepidoptera, 2 to Neuroptera, 1 each to Diptera, Hymenoptera and Orthoptera, and 2 are of general interest.

The illustrations consist of 25 plates, of which 2 are collotype, 11 are half-tone, and 12 are line-block, as well as a number of diagrams and text-figures. The originals have in all cases been provided by the authors, and thanks to the kindly offices of Prof. Poulton, a generous contribution of £50 has been received from Jesus College, Oxford, towards the cost of the volume, in addition to a similar sum given last year.

The Proceedings will consist of about 100 pages, and are illustrated by one half-tone plate (the cost of which is borne by Prof. Poulton) and a few text-figures.

During the year the Society has become affiliated to the Conjoint Board of Scientific Societies. Dr. Neave has been nominated as the Society's representative on the Board, and it is hoped that this influential body will be of great assistance in supporting the interests of all the Scientific Societies affiliated to it.

The attendance at the meetings has been remarkably good, and appears to be the highest on record. This is doubtless due in large measure to the attractions of our new quarters. The average number of Fellows and visitors present at meetings during the year has been 68 as compared with 51 in the two previous years or 57 in the last pre-war year.

The experiment of holding a few informal meetings in certain months when there is no second ordinary meeting was made during the year. Those held in April and May were not very successful, but the meeting held on 4th January last was well attended.

The conduct of the detailed work of the Society's business which was formerly carried on by the Business Committee has been divided amongst a Finance and Housing Committee under the chairmanship of Dr. G. A. K. Marshall, a Publication Committee under the chairmanship of Mr. G. T.

Bethune-Baker, and a Library Committee under the chairmanship of Mr. J. H. Durrant, with extremely satisfactory results. The standard of attendance at these Committees has been remarkably high, and the Council is greatly indebted to those Fellows who have so ably assisted by serving on them.

The Council also wishes to express its thanks to Mr. Wheeler for having compiled an index to the Standing Orders of Council covering the period of 10 years to February 1921. This index will be kept up to date for the future.

The Librarian reports that the year under review has been one of transition for the Library, and that much still remains to be carried out before a really satisfactory state of its affairs can be said to have been reached.

Early in the year the books were transferred from Chandos Street, and, while they have been placed approximately in the same relative positions as in the old quarters, the opportunity has been taken to separate and classify under countries the whole of the very large series of periodicals; this at once renders them easy of access, which had not been the case for many years past. The Hon. Librarian regrets that he has not been as free as he expected, and has thus been unable to devote as much time to the Library as he hopes to do during the coming year. Still much work has been done in that every volume can be seen without removing a whole row of books, which was often inevitable in the old quarters. It will have been observed that it is now possible to display all the current magazines and additions on the Library table, that all the ordinary catalogues and books of very general reference are placed together in the new fitment for the general Catalogue of the Library, and that most of the Separata, of which the Society possesses a very large number, are now much more accessible than formerly.

By donation and purchase 135 Volumes have been added with some 273 Separata and Reports. A list of these, together with the accessions for 1920, which it was found impossible to include in the Transactions for last year, has been prepared and will appear in Part V of the Transactions for 1921.

The number of volumes bound or rebound is 99, and this work will be continued in the present year as far as funds permit.

From the records in the office, 184 Books and Separata have been borrowed during the year. In this connection, it may be mentioned, that the list of works (valuable, rare, bulky, and of frequent reference) not allowed out on loan has been revised by the Council. This may be consulted by Fellows in the Office.

The Library has not been used for consultation during the year to the extent that was expected, but no doubt as its convenience becomes more known, more use will be made of it. At the present time a series of dictionaries is being obtained, and these will be available in a few weeks.

The Report was adopted on the motion of Mr. T. H. L. Grosvenor, seconded by Mr. Stanley Edwards.

The Treasurer's Report.

The Treasurer then read the following Report :—

It is my great pleasure to be able to report at this the first Annual Meeting held in our new freehold home, that thanks to the generous assistance received from the Fellows, the finances of the Society have been placed upon a sound basis, and that there is every prospect of its being able to carry out its proper and necessary objects free of anxiety so far as finance is concerned.

The organisation of expenditure during the past year has not been without difficulty; for the experience gained under the old conditions could not be relied upon, the new conditions being so different. For this reason it was necessary we should base our expenditure upon an estimate of the probable amount of income that would accrue during the year, and that we should keep it down as much as possible to avoid the unpleasant experience of the first year's working showing a deficit. Thanks to certain unexpectedly favourable financial features, which will appear later, the result has been that the income for 1921 has exceeded the expenditure by the substantial sum of £124 4*s*. 9*d*., which I trust will be considered a very satisfactory commencement of the new conditions.

Finance having had to play such an important part in the Society's operations during the past year, it is obvious a special method of dealing with it in this Report is necessary; I must therefore go into details to a much greater extent than has been customary hitherto.

I will first deal with the questions arising out of the Society's acquisition of the Freehold of No. 41, Queen's Gate, and No. 15, Elvaston Mews.

It will be remembered that the estimated amount of the cost of the Housing Scheme was £10,000. There is always considerable uncertainty as to the eventual cost of such a plan, because so much depends upon factors that only appear as it develops, and upon the good or ill fortune that all human affairs are subject to, and which cannot be foreseen. In view, therefore, of the well-meant fears that were expressed by certain of our friends that the estimated cost of the Scheme would be greatly exceeded—I heard a sum of £15,000 mentioned—it will, I am sure, be learned with relief and pleasure, that these gloomy prophecies have not been fulfilled. Not only has the sum asked for not been exceeded, but there is a large saving on it. The total expenditure being £8450 8*s.* 4*d.*, or a saving of £1549 11*s.* 8*d.* on the amount of the original estimate. The details of this expenditure are as follows:—

	£	*s.*	*d.*
Acquisition of the Freehold of No. 41, Queen's Gate, and No. 15, Elvaston Mews, including all legal expenses and surveyor's charges .	6666	17	7
Repairs, alterations, and decorations to 41, Queen's Gate	1118	3	11
Removal of the Library and bookcases from Chandos Street, providing new bookcases, and altering and fixing the old ones . . .	207	9	8
Furnishing	411	2	2
Sundries	46	15	0
	£8450	8	4

I might perhaps be permitted to mention here, that when this Housing Scheme was first brought before the Council,

I was asked what I considered it would cost if adopted. My reply was, that provided we were fortunate in securing suitable premises for a reasonable price, the total expenditure might not exceed £7000 or £8000, but that in any case it should not be more than £10,000.

The Housing Fund has progressed well during 1921. The amount of donations promised at the end of 1920, £3404 18*s.* 6*d.*, having by the conclusion of last year reached the sum of £4095 4*s.* 11*d.*, an increase of £690 6*s.* 5*d.* This amount includes handsome donations of £105 from the President, Lord Rothschild; £63 from Mr. W. G. F. Nelson, and £50 each from Messrs. W. M. Christy (a further donation, making £100 in all), W. J. Kaye, and W. Schmassmann, and a very important and valued gift from Mr. R. Adkin of the amount of his Debentures drawn on October 31st last (£40).

The total amount of the Housing Fund to the end of last year was £9451 9*s.* 3*d.*

I will next deal with the financial result of the acquisition of the new premises from the annual income and expenditure point of view.

Once it was decided that the Society could no longer be content with its extremely inadequate accommodation at Chandos Street, there seemed three possible alternatives for it to adopt.

(1) To obtain from the Government, accommodation in a similar manner and of a similar nature to that afforded to the Learned Societies at Burlington House.

(2) To become a tenant of rooms of sufficient capacity to satisfy its present requirements.

(3) To acquire its own Freehold premises, letting off such portions as were not required at present for its own occupation.

Now let us see where we should have stood had we adopted either of the two former alternatives, and where we stand under the third alternative, which we have adopted.

First let us take No. 2, and suppose that we had eventually as tenants found accommodation suitable to our present requirements; what would have been the probable financial result? I should observe here that the Housing Committee

did make a very lengthy search, without success; and judging from the fact that there are several Societies who have been unsuccessfully searching for accommodation similar to our requirements for several years, it does not seem likely that they would have attained the desired object in a reasonable time.

Rents for the kind of accommodation we required have increased enormously of late years, and bearing this in mind, and that the accommodation rented to us at Chandos Street for £70 7*s.* 6*d.* per annum was, before we vacated it, relet for £185 per annum, the new tenants having in addition to pay the increased rates involved by the larger rental obtained, and therefore becoming responsible for an annual expenditure of at least £200, makes it probable that we should have had to pay about £300 per annum for our requirements, with the certainty that in a few years, owing to the gradual increase in the number of Fellows and the steady growth of the Library, we should have been in as great a state of overcrowding as we were at Chandos Street.

Alternative No. 1 was, of course, attempted, but the Government was not able to grant us suitable accommodation. Had it been available, on the most favourable terms conceivable we should have obtained it free of rent; our establishment charges would have been, for reasons which will be seen later, considerably higher than they are at present.

The position under alternative No. 3 is as follows. The sole liability of the Society in connection with its new home is the Debentures. The total amount of these issued was £5290, of this amount £650 was, however, repaid on November 1st last, and notice has been given to pay off a further £100 on February 1st next. The amount then outstanding will be £4540. The interest on this sum is £227 per annum. Against this the portions of the new premises not occupied by the Society are leased to excellent tenants on repairing leases for a term of years, or are otherwise available for income. They produce the net income of £410 per annum. It will thus be seen that not only is the Society rent free, but it obtains in addition even at present, the substantial net income of £183 per annum from its purchase. This income

will, of course, gradually increase as the Debentures are redeemed.

Even this does not represent the full advantage the Society obtains by owning its own premises, for by becoming a Registered Friendly Society—which it is entitled to do by its objects and Bye-laws—it is able to avail itself of a statute freeing it from the payment of all rates. The tax assessors have also excused it the payment of income tax and inhabited house duty. These exemptions represent a saving of about £300 per annum, and they were obtained for the very moderate outlay of one guinea.

It will be seen under what extremely favourable terms the Society enters into the ownership of its "Home," and it is safe for me to state that, subject to the continued generous and hearty support of the Fellows, which I feel sure will be afforded, the new era will commence with prospects quite beyond its horizon a few years ago.

I have to report another splendid success, vitally affecting the Society's future. I allude to the increase in income derived from annual subscriptions. The total number of subscriptions for 1921 received to December 31st last was 564, of those no less than 528 were at the increased rate of two guineas, and of the remainder, four were voluntary annual subscriptions in lieu of additional Compounding Fees, leaving the very small number of 32 Fellows who paid their subscriptions at the old rate of one guinea. This result is extremely satisfactory, and I feel that it has been produced by the loyalty and good feeling of the Fellows to the Society. I am quite sure that numbers of them who would have desired to contribute to the Housing Fund, but who were unable to do so, have embraced this method of assisting the Society, and I should like to tender to them in its name my very grateful thanks for their valuable and much-appreciated help. Thanks to this result and to the additional number of Fellows, the income from current year subscriptions has increased from £567 to £1145 7*s.* 6*d.*, an addition of no less than £578 7*s.* 6*d.*, or more than 100 per cent.

In consequence of the increased subscription we have undoubtedly lost a few Fellows, as unfortunately was only to

be expected, but the losses from this cause can only have been very few, for the total number of resignations in 1920, in which year the increase was first mooted, and in 1921, is only 38, but there were 13 resignations in the previous two years, and therefore it would appear that only about 25 can be attributed to the increase of subscription. Against these losses in the last two years, no less than 124 new Fellows have joined our ranks.

Prominent amongst the donations in aid of the publications is the sum of £100 from Jesus College through Prof. Poulton (half of this was given in 1920, but not acknowledged), £29 5*s*. 0*d*. from the late Dr. T. A. Chapman, and £22 15*s*. 4*d*. from the President. The two latter donations are for the cost of plates in the 1920 Publications.

The Society is indebted to Mr. J. J. Joicey for a handsome and very useful lantern, and to the President for some necessary fire-extinguishers; to Prof. Poulton for a very interesting desk slope that was used by Alfred Russel Wallace for many years, and to the late Dr. Longstaff for a handsome portrait of his kinsman, W. B. Spence, and one of W. Kirby. Our warm thanks are due to these generous donors for their much-appreciated benefactions. I should like here to say that I hope those who possess objects of general interest to Entomology will be able to see their way to give or bequeath them to the Society, so that they may be available for the benefit of posterity.

The sale of the Society's Publications has brought in considerably more than last year, and the sum realised amounts to £181 11*s*. 3*d*. This is the largest sum accruing from this source in any one year. Now that the Society has undertaken the sale of the whole of its Publications, and has the necessary staff to attend to it, this source of income should be more lucrative.

During the year the sum of £205 17*s*. 2*d*. has been added to the Compounding Fund, a further £66 2*s*. 4*d*. is now available, and will shortly be invested. The amount of interest received on account of this fund in 1921 was £48 17*s*. 10*d*., and as the Fellows who had compounded for their subscriptions were reduced by the death of four of their number, the income

arising out of the fund will next year equal about 17*s.* 6*d.* per Compounding Fellow, instead of 16*s.* a year ago.

I am glad to be able at last to report an increase in the value of the Society's stocks; Consols show an increase of £71 2*s.* 9*d.*; whilst the purchase of 1918 War Loan made in recent years, which is being added to annually, shows a profit on the cost price of £13 19*s.* 0*d.* As to the income received from the rent of property and the contributions from tenants towards the cost of House expenses, nothing is included in the year's accounts for the rent of No. 15, Elvaston Mews, which commenced on September 29th last, and only nine month's rental and contribution to the cost of House expenses from the Imperial Bureau of Entomology. I have adopted this procedure because it is practically impossible to obtain with certainty rents due on the 25th of December before the end of the financial year on the 31st, so that they are available for inclusion in the accounts. In future, of course, a full year's income will be available from these sources, and the concluding quarter will be carried forward to the succeeding year.

I am glad to report that the Society has succeeded in making terms with its Printers which will reduce the price of its Publications by about 20 per cent.; but the cost is still very high, being something like 110 per cent. more than that which obtained in 1914.

In 1921 we paid the Medical Society of London rent to the amount of £31 13*s.* 9*d.*; this expense, of course, will not recur.

The items of expenditure on repairs to premises and Agent's charges are responsible for £172 18*s.* 7*d.* This large sum is almost entirely owing to the Society being compelled to put No. 15, Elvaston Mews in tenantable repair, and to install the electric light, previous to obtaining a tenant. As this property is now let on a repairing lease to a responsible tenant, it should not involve further expense to the Society, at any rate for a number of years. The total cost of repairs to the property will average very much less in future than it was last year. Certain items of expenditure, which last year were in the experimental stage, especially the consumption of gas, are likely to be reduced in future.

I think it will be realised from the foregoing facts that there is every prospect of the Society having a prosperous financial future, but this can only be realised by sound methods of procedure. A Society, like most institutions and individuals, can only be made prosperous gradually; its future requires to be built up by continuous effort, by the soundness of its business methods, and by its careful look-ahead finance, which not only provides for the necessities of the day, but anticipates the future, and, knowing its requirements, keeps them steadily in view until eventually they are realised. It is a fact that the individual who has realised what he wants, is more likely to attain those requirements than if he did not grasp their nature and plan for them, and so it is with a Society like ours; I venture therefore to put the following points and suggestions before the Fellows.

There are two difficulties vitally affecting the Society that will arise in the future. One of these is the increased Library space that will be necessary, and the other the necessity at some future date of providing a larger meeting-room, which should have better acoustic properties.

To deal with the question of the Library requirements first. It has always been the case that every Society possessing a library, including our own, tends very rapidly to outgrow its accommodation; this is inevitable, for each year sees large increases made to its collection of books, especially those in the department of Periodical Literature.

We have at present considerable spare room in the Library, and there is a possibility of somewhat increasing the space available without making structural alterations; but I estimate that in, say, ten years, our available shelf room will all be utilised. We *must* then provide additional space.

The meeting-room question will, I think, require to be dealt with at the same time, because the additional space for the Library will have to be either in the present meeting-room, or in connection with the new meeting-room which can be erected on the spaces now occupied by the kitchen of No. 41, Queen's Gate, and the garage at 15, Elvaston Mews.

Our first task, of course, must be to pay off the present issue of Debentures. As I have previously stated, a start

has already been made, and as there is now a considerable sum available to the credit of the Housing Fund, and further sums being promised, and the Council having assented to a diversion of a minimum of £200 per annum from the Society's income, to assist, I hope a further substantial amount of these Debentures will be redeemed during the present year. We must, of course, arrange that sufficient of our income is available to provide adequately for the Publications, and for the various other items of expenditure that are necessary to uphold the objects and dignity of the Society; but after these are satisfied, the remainder of its available funds should go to provide for its future welfare.

There are various methods by which the Society's prospects can be assisted and assured, amongst them are the following :-

1. By continuing the present Sinking Fund of £200 per annum, and by increasing it as much as possible, subject of course to the other necessities of the Society as before indicated, being adequately provided for. The decision on this point, of course, rests with the Council.

2. By donations to the Housing Fund from Fellows who have not yet contributed to it.

3. By any Debenture-holders who are able and willing to do so, following the example of one of them, and cancelling the whole or part of their Debentures when drawn.

4. By making bequests to the Society. I take it we would all like the world to become a little better for our having lived in it; and those of us who are possessed of more riches than the necessities of our immediate dependents require, search for some worthy charitable cause or institution to which we make a bequest. May I put it to those Fellows who are able to adopt this course, that our Society is a charitable institution capable of becoming of great benefit to Entomology if it is adequately supported; and that it is well worthy of their assistance. Entomology has done a great deal for all of us; is it not incumbent on us to do what we can for it?

I feel sure these suggestions, and others that will occur to the Fellows, will receive their generous and careful consideration, for the loyalty and good will which has been shown to

the Society makes it evident that every one is anxious to do his or her best to make it worthy of itself, and of the great science of Entomology.

The TREASURER also read extracts from the Financial Statement, and both Report and Accounts were adopted on the motion of Mr. A. E. TONGE, seconded by Dr. E. A. COCKAYNE.

The PRESIDENT declared the Fellows nominated by the Council as Officers and Council for the ensuing year to be duly elected in accordance with the Bye-laws.

The PRESIDENT then read an Address. At its conclusion a vote of thanks to him, moved by Mr. BETHUNE-BAKER, coupled with the request that it might be printed in the Proceedings, was passed with acclamation.

The PRESIDENT having replied, a vote of thanks to the Officers was then carried on the motion of Mr. E. E. GREEN, seconded by Dr. C. J. GAHAN.

THE ENTOMOLOGICAL SOCIETY OF LONDON.

TREASURER'S ACCOUNTS for the Year ended December 31, 1921.

(Presented at the Annual Meeting, January 18, 1922.)

RECEIPTS AND PAYMENTS ACCOUNT.

Receipts.	£ s. d.	£ s. d.
To Cash at Bank as per last Account—		
General Account	316 4 4	
Compounding Fund	206 7 0	
Library Fund	51 5 1	
		573 16 5
„ Interest on Investments—		
Birmingham 3 % Stock (Westwood Bequest)	7 3 8	
Consols	31 6 3	
National War Bonds	12 10 1	
Income Tax recovered	5 1 6	
„ Interest on Deposit—		
General Account	26 9 10	
Housing Fund	21 12 3	
„ Rents from Sub-tenants	205 11 1	
		309 17 8
„ Compensation in consideration of Termination of Lease		105 0 0
„ Contribution by Tenants towards House Expenses		98 18 6
„ Admission Fees	131 5 0	
„ „ „ paid in error	6 6 0	
		137 11 0
„ Annual Subscriptions—		
Arrears	27 9 0	
1921	1,109 15 0	
In Advance	29 8 0	
		1,166 12 0
(Subscriptions for 1921 received in 1920, £38 14*s.*)		
„ Sales of Publications		181 11 3
„ Donations in aid of Publications		121 15 1
„ Miscellaneous Receipts		28 5 6
		£2,723 7 5

Payments.	£ s. d.	£ s. d.
By Rent		31 13 9
„ Salaries		329 13 3
„ Library—		
New Books	58 18 9	
Binding, Repairs and Insurance	36 2 0	
		95 0 9
„ Cost of Publications—		
Printing	400 7 2	
Illustrations	110 10 1	
Distribution	28 9 11	
		539 7 2
„ Sundry Printing and Stationery	79 17 6	
„ Postage	26 7 5	
		106 4 11
„ Audit Fee		5 5 0
„ Miscellaneous Expenses		39 4 1
„ House Expenses—		
Fuel, Gas, and Electric Light	55 12 5	
Insurance	10 10 0	
Water	13 11 0	
Repairs and Alterations	158 3 1	
Agent's Charges	14 15 6	
Sundry Expenses	21 4 1	
		273 16 1
„ Interest on Debentures	175 7 3	
„ Income Tax Deducted	30 13 9	
		206 1 0
„ Rent paid over against Compensation for Termination of Lease		16 2 3
„ Purchase of £213 9*s.* 7*d.* 5 % National War Bonds, 1928		205 17 2
„ Transfer to Housing Fund		200 0 0
„ Cash at Bank and in Hand—		
General Account	543 17 2	
Compounding Fund	66 2 4	
Library Fund	57 18 10	
Westwood Bequest Fund	7 3 8	
		675 2 0
		£2,723 7 5

MEMORANDUM AS TO ASSETS AND LIABILITIES AT DECEMBER 31, 1921.

ASSETS.

	£ s. d.	£ s. d.
To Freehold Premises 41, Queen's Gate, S.W. Cost of Purchase		6,250 0 0
„ Library, Furniture and Fittings ...	Not valued *	
„ Present value of—		
£1,354 2*s.* 2*d.* 2½% Consols, Compounding Fund (Cost £1,233 3*s.*)	680 8 9	
£350 14*s.* 1*d.*, 5% National War Bonds 1928 (3rd Series), Compounding Fund, (Cost £340 5*s.* 2*d.*)	354 4 2	
£239 12*s.* 4*d.* Birmingham Corporation 3% Stock, Westwood Bequest (Cost £250)	127 0 1	
		1,161 13 0
„ Amounts due to the Society—		
Subscriptions	109 4 0	
Admission Fees	25 4 0	
Publications	19 11 9	
Rents and Contributions to House Expenses	127 10 0	
	281 9 9	
Less not considered good	20 0 0	
		261 9 9
„ Cash at Bank and in Hand—		
General Account:		
On Deposit £300 0 0		
Current Account 136 18 6		
In hands of Solicitors ... 105 0 0		
In hands of Treasurer ... 2 2 0		
Less amount due to Secretary ... ... 544 0 6 / 0 3 4	543 17 2	
Housing Fund:		
On Deposit 150 0 0		
Current Account 193 19 7		
	343 19 7	
Compounding Fund Current Account..	66 2 4	
Library Fund Current Account	57 18 10	
Westwood Bequest Fund Current Account	7 3 8	
		1,019 1 7
		£8,692 4 4

LIABILITIES.

	£ s. d.	£ s. d.
By Amounts Due from the Society—		
Printing Transactions, Parts III, IV, and V	334 6 9	
Sundry Accounts	85 5 9	
		419 12 6
„ Subscriptions received in Advance ...		29 8 0
„ 5% Debentures—		
Issued to provide for Purchase of 41, Queen's Gate S.W.:		
As at 1st January, 1921	4,840 0 0	
Add Issued during year ...	450 0 0	
	5,290 0 0	
Less Repaid during year ...	650 0 0	
	4,640 0 0	
Add Interest Accrued	39 11 8	
		4,679 11 8
„ Excess of Assets over Liabilities—		
General Account	316 14 9	
Housing Fund	1,953 19 7	
Compounding Fund	1,100 15 3	
Library Fund	57 18 10	
Westwood Bequest Fund	134 3 9	
		3,563 12 2
		£8,692 4 4

* Stated by the Treasurer to be worth £5,000.

HOUSING FUND.

Receipts.	£	s.	d.
To Balance at Bank as per Last Account	1,623	5	7
,, Transfer from General Account	200	0	0
,, Donations	920	17	5
,, Debenture Bonds Issued	450	0	0
	£3,194	3	0

Payments.	£	s.	d.
By Legal Expenses in connection with Purchase of 41, Queen's Gate, including Licences and Stamps	298	1	0
,, Interest on Purchase Money	26	16	2
,, Surveyor's Fees	92	0	5
,, Repairs and Alterations	1,118	3	11
,, Removal of Library, providing Additional Book-cases, and expenses in connection with same ...	207	9	8
,, Furnishing	411	2	2
,, Sundry Expenses...	46	10	1
,, Repayment of Debentures	650	0	0
,, Cash at Bank	343	19	7
	£3,194	3	0

WESTWOOD BEQUEST FUND.

	£	s.	d.
To Interest on £239 12*s.* 4*d.* Birmingham 3% Stock ...	7	3	8
By Balance at Bank at date	7	3	8

LIBRARY FUND (NEW BOOKS).

	£	s.	d.		£	s.	d.
To Balance at Bank, January 1, 1921	51	5	1	By Expenditure on New Books	58	18	9
,, One-half of Admission Fees received in 1921 ...	65	12	6	,, Balance at Bank at date	57	18	10
	£116	17	7		£116	17	7

COMPOUNDING FUND.

	£	s.	d.		£	s.	d.
To Balance at Bank, January 1, 1921	206	7	0	By Investment in £213 9*s.* 7*d.* 5% National War Bonds 1928	205	17	2
,, One-half of Admission Fees received in 1921	65	12	6	,, Balance at Bank at date	66	2	4
	£271	19	6		£271	19	6

HOUSING FUND.

	£	s.	d.	£	s.	d.		£	s.	d.	£	s.	d.
To Receipts in 1920	7,880	11	10				By Payments, 1920	6,257	6	3			
,, ,, ,, 1921	1,570	17	5				,, ,, 1921	2,850	3	5			
				9,451	9	3					9,107	9	8
							,, Cash at Bank at date				343	19	7
				£9,451	9	3					£9,451	9	3

W. G. SHELDON, *Treasurer.*

We have audited the Treasurer's Accounts of Receipts and Payments and the Statement of Assets and Liabilities with the Books and Vouchers of the Society, and certify them to be correct. Messrs. Burch & Co., Solicitors, of 6 Bolton Street, W., have certified to us that they hold the deeds of the property on behalf of the Trustees for the Debenture Holders. We have verified the other Investments and Bank Balances.

23, *Queen Victoria Street, London, E.C.* 4.
January 17, 1922.

(*Signed*) W. B. KEEN & Co., *Chartered Accountants.*

THE PRESIDENT'S ADDRESS

Ladies and Gentlemen,

It is for the first time that we hold the Annual Meeting in our house, and we may look back upon the session which ends to-night as the first year of a new era in the annals of our Society. When the matter of a new house owned by the Society itself was first mooted, there were many who looked upon the proposition as a hazardous experiment and who would have preferred to continue in the old quarters and not take any risks. There is certainly a risk attached to everything new and untried, but if after due consideration this risk is found small in comparison with the advantages of a new move, the demand for progress must be obeyed. The year we have behind us has fully borne out the prediction of those who advocated the scheme and so successfully carried it out. You have heard the Council's Report, and I think you will agree with me that we may congratulate ourselves on the status of the Entomological Society of London, not only as regards its finances and the increased number of its Fellows, but also in respect to its position among scientific societies. However, before a new home is in perfect order a great deal of important work is required of those who are responsible for it, and our most grateful thanks are due to the Hon. Secretaries, the Treasurer and the Hon. Librarian for the untiring devotion they gave to their tasks. The removing and rearrangement of the Library in particular was a difficult undertaking, which, however, has been very well accomplished, and the books for the first time can be conveniently consulted by the Fellows of the Society. The secretarial and editorial work, unfortunately, has been much hampered by two deplorable events. Early in the year the Rev. George Wheeler was compelled by

continued ill-health to give up the onerous duties of Hon. Secretary of this Society, and to its profound regret the Council had to accept his resignation from an office which he held with such distinction since 1911. Mr. Wheeler's predecessor in office, Mr. H. Rowland-Brown, kindly consented to undertake again the duties of Hon. Sec., but a very serious illness which attacked him in the summer and rendered him prostrate did not permit him to continue in office. We are all most grateful to both Mr. G. Wheeler and Mr. H. Rowland-Brown for their great services to this Society, and we all wish and hope that both will speedily recover and continue in full health their entomological work in the field and again be among us in these rooms at our meetings and social gatherings. We have to tender our best thanks to Dr. H. Eltringham for coming to the rescue and accepting the office left vacant by the resignation of Mr. H. Rowland-Brown.

The bereavements of the Society by the death of Fellows have been unusually numerous and severe during the past session. Death has struck off our rolls no less than eighteen Fellows. Several of them have been such familiar figures at our meetings that we shall greatly miss them from our gatherings, though they will ever remain present in our minds as devoted fellow-Entomologists.

Dr. G. B. Longstaff, whose generosity towards our Society when he was already very ill and could no longer attend the meetings is still fresh in our memory, was a man of wide interests with a great love of nature, science and art. His contributions to Entomology and the ever-ready support his sympathetic nature accorded to science with sound counsel and generous deed, and the collections made during his extensive travels and presented to the Hope Department, are only part of the many services he rendered his country. Public affairs had his devoted attention no less than science, and his work as a member of the London County Council was as thorough and circumspect as everything his energetic and persevering nature undertook or investigated. As an Entomologist he was much more than a collector. His active mind considered the amassing of specimens and field observations not as the final object of Entomology, but as a means to the

higher end of solving biological problems of importance. Whenever he could, he directed his every energy during his travels to the task of bringing together evidence bearing on some biological problem.

Yorkshire has lost two of its distinguished Entomologists. Dr. H. H. Corbett was one of the leading spirits in the scientific and literary life of Doncaster and, ably supported by his wife who was as keen an Entomologist as himself, did much valuable work in connection with the Coleoptera and Lepidoptera of his district. To Mr. J. W. Carter, who died at Bradford on December 15th of last year, many new records are due in Hymenoptera, Neuroptera, Lepidoptera and other orders.

John Gardner, of Hartlepool, a Fellow of this Society since 1890, did much good work in the exploration of the Lepidoptera and Coleoptera of Durham. He enriched the lists of that county by many rare species, and will be specially remembered as the discoverer of the larvae of several Microlepidoptera. His great kindness to younger Entomologists and his readiness to place his knowledge at the disposal of his fellow-workers endeared him to all who came in contact with him. We had the pleasure of meeting him at Tring in 1912, on the occasion of the visit of the members of the International Entomological Congress to my Museum.

Professor L. C. Miall joined the Society in 1894, and was elected a special life member in 1916 for his distinguished services to Entomology. He is best known to us by his book on Aquatic Insects and the Monographs on the Cockroach, the Harlequin Fly and the Tipulid *Phalacrocera replicata*. As professor of Biology in the University of Leeds his interests embraced the wide field of Biology as well as Education.

Mr. J. C. Hawkshaw, of Liphook, Hants, devoted much time and care to Microlepidoptera, and the Rev. H. M. Bratzer, Mr. F. M. Campbell, Mr. T. S. Hillman, Mrs. C. A. Melville, Mr. W. D. Robinson-Douglas and Mr. F. G. Whittle did much good service in the investigation of the local fauna of their counties.

Among our losses are three who lived in oversea countries. Mr. A. Mullen, professor of Biology at Bombay, Professor Fernald, of Amherst, Mass., and Professor T. Miyake, of Tokyo.

Charles H. Fernald died at the ripe age of 83. He was one of the great pioneer teachers of Entomology in the U.S.A., whose works on New England Lepidoptera and North American Micros have made his name familiar to European Entomologists.

Professor Tsunetake Miyake was particularly occupied with the study of Economic Entomology, of which he was a teacher at the Imperial University of Tokyo. He has published a treatise on general Entomology in two volumes, and many papers on various entomological subjects. Having contracted typhoid fever, he died on February 2nd, 1921, at the early age of 40.

Among the foreign Entomologists who died during 1921 two stand out prominently. Monsieur Albert Fauvel, of Caen, France, the well-known specialist in Staphylinidae and editor of the Revue d'Entomologie, and Herr Edmund Reitter, of Paskau in Moravia, the celebrated Coleopterist, who has described more Palaearctic beetles than any other author. Reitter is the author of nearly 10,000 genera, species and varieties, and his publications number over a thousand. His collection was bought in 1916 by the National Hungarian Museum at Budapest.

Shortly before the close of the year the sad news reached the Society that they had yet to mourn another bereavement. Dr. T. A. Chapman died on December 17th, 1921. He had been seriously ill the year before, and we knew that he was far from well, yet we hoped that he would recover once more and be able to enjoy the continuance of his pursuits. His death leaves a vacant place in Entomology which it will be difficult to fill. Dr. Chapman, an intimate entomological friend to many Fellows of this Society, typifies a kind of Entomologist of which there are far too few. If Edmund Reitter was chiefly concerned with describing and classifying genera and species and in his line surpassed all records, Dr. Chapman had no predilection for that essentially nomenclatorial side of science, but devoted his energies to the study of morphology and bionomics, and the results of his patient and painstaking researches in the life-histories of European Lepidoptera stand so high, are so reliable, and are so much

appreciated, that Dr. Chapman was looked upon at home and abroad as being the foremost British Lepidopterist. He joined the Society in 1891, serving no less than four times on the Council, and was a most regular attendant of the meetings, where he will be much missed by us all.

I will now proceed to read my address on

Algeria and its Fauna.

Most of us, if not all, have started in Entomology as collectors in the field, attracted by the charm of colour and form displayed by insects, and stimulated in a pursuit of knowledge by the infinite variety in body and habits observed in the insect world. We can call ourselves fortunate in feeling a delight in the observation of these small fellow-members of creation, which are a continual source of pleasure, whether we are engaged in serious research in the entomological laboratory or are on a holiday either at home or abroad. This being so, I trust you will permit me to take you to-night to a country in the fauna of which I am particularly interested and which in many respects is an enchanting district for a naturalist. I must, however, ask your indulgence if I, in order to emphasise my points, lead you occasionally aside from Entomology.

Since its successful pacification during the middle half of the last century, Algeria has become safer for the tourist and explorer than many European countries, and its fauna and flora are at the present day better known than those of the Balkan States. Like the Balkan Peninsula, Algeria and Tunisia were part of the civilised world at the beginning of the Christian era and sank back into barbarism during the Middle Ages, being opened again to civilisation only a few generations ago, during the time of our grandfathers. The familiar names of Carthage, Hannibal, Juba, Jugurtha, Masinissa, and of the Christian fathers Tertullian, St. Augustine and St. Cyprian, recall to our mind that a large portion of North Africa was highly advanced at a time when Northern and Central Europe were still in barbaric darkness. At the beginning of the Christian era, the Mauretania of the Romans (Maurusia of the Greeks) was divided into two provinces: the western province of Mauretania Tingitana corresponded to the

present-day Morocco and was subject to Rome more in name than in fact, and the eastern province of Mauretania Caesariensis comprised what are now called Tunisia and Algeria, with Julia Caesarea, the present-day Cherchell, as capital. Though the Romans actually occupied only the coast region and a portion of the plateaux south of the northern range of mountains, they came as far south as Biskra, everywhere building roads and bridges and establishing military outposts. The nomadic tribes of the interior of Mauretania, the Numidae (from the Greek Nomades), as they were called, remained practically independent. When the Roman Empire became decadent and inner dissensions weakened its power in the conquered provinces held by their legions, a Roman general in Mauretania applied for help to the Germanic warrior tribe of Vandals, then resident in Spain, and this tribe, following the call for help, helped itself to all there was in the country and soon became masters not only of Mauretania, but of Sicily, Sardinia and Corsica, defeated the Romans everywhere and incidentally sacked Rome itself, though less successfully than the Romans in the case of Carthage. Their sway over the Mediterranean lasted only a century. The tribe was gradually exhausted and became absorbed by the population of the country, which then fell into the hands of the Byzantine Empire. Traces of the infusion of Germanic blood into the indigenous Berber population are said still to be found in eastern Algeria, where fair-haired and blue-eyed Berbers are occasionally met with, just as there is a type of man among the shepherds in the mountains of northern Portugal which recalls the long occupation of the Iberian Peninsula by the Germanic Visigoths.

The Byzantinians, under Belisar, established themselves in Mauretania, but did not extend their power to Oran and Morocco, which became independent and fell back into barbarism. Under Byzantinian rule, strong fortresses and numerous churches were built, only to be swept away a century later by another invasion. In the second half of the seventh century the irresistible hordes of Mohammedan Arabs pushed west over North Africa and made here an end of Christianity. The influx of the Arabs drove the inhabitants of Mauretania,

the Berbers, into the mountain fastnesses, where they held their own for a long time. Mauretania became an Arab country, which, on account of the great distance from Egypt and Arabia, soon began to develop on its own lines and formed an independent empire. It is interesting for a naturalist to observe how quickly ideas changed in the new home of these Arabs, and how quickly a new civilisation took the place of the one brought from Arabia and Egypt. The Moorish realm, which grew up in North Africa, soon extended into Spain as far north as the Ebro. Education and commerce flourished, art and literature soared to great heights, and, as we could expect under such circumstances, the religious creed became modified, and gradually a great cultural antagonism resulted with the Mohammedans of North-East Africa. About 1200, fanaticism in Egypt got the upper hand and new armies rolled west, and like a stream of lava destroyed everything destructible; only a small proportion of the Mauretanian Arabs found a refuge on the stony plateau of the desert, their descendants being the Mozabites residing in the district south of Laghouat, at Ghardaia. Civilisation and culture disappeared in Mauretania; the country became weak and fell an easy prey to the Spanish and Portuguese, who occupied the harbours and coast districts and who, in their turn, were driven out by the Turks.

Under Turkish rule, which was a rule more in name than in reality, lawlessness reigned supreme, and the development of a state of things took place which may be likened to the period of the robber knights of Europe. Lawlessness attracted the refuse of mankind and adventurers from all countries, and we see a rapid development of the notorious scourge of the Mediterranean familiarly known as the Barbary corsairs. Under the corsairs the town of Alger became the most important of all ports, and the Dey of Alger, installed in his power by the Sultan of Constantinople, was master of the Mediterranean Sea and coasts, and considered everything on sea and land that fell into the hands of his corsairs as his legitimate property, inclusive of the sailors and passengers found on board the ships captured. The European countries, as usual busily occupied in cutting each other's throats, were quite helpless against the corsairs and paid a yearly tribute

to the Dey in money and goods, particularly armaments, as also did the U.S. of America. It was in 1830 that the power of the Dey of Alger was definitely broken and that the country entered on a new era. I have briefly alluded to these historical facts, as the traces of the various conquests and attendant destruction are found all over Algeria and are one of the outstanding features of the country, and because the historical events which have passed over this region have had on the fauna an effect on the whole as beneficent as it was disastrous for the human races.

The African continent resembles in general outline South America so closely that one might be inclined to look upon North Africa, with regard to the fauna and flora, as being as much a part of Africa as the Guianas, Venezuela and Colombia form part of South America. The larger Algerian animals, those which appeal most to the imagination, the lion, leopard, hyaena and ostrich, are indeed closely associated in our mind with tropical Africa. When, however, we more critically examine the fauna of Mauretania, a very small percentage of the species of Algeria will be found to be really of Ethiopian descent. There are two factors which place North Africa faunistically in quite a different position from the northern countries of South America: Mauretania has about the same latitude as Texas and North-West Mexico, and it is separated from tropical Africa by a wide desert belt, which is as effective a barrier as a wide expanse of sea. Both these factors act in the same direction, joining North Africa in climate and geographical continuity or propinquity to the Mediterranean countries of Asia and Europe rather than to tropical Ethiopia. It therefore affords better conditions for immigration from the east, west and north than from the south, and for a corresponding extension of the Mauretanian indigenous species. For the composition of the fauna of a country is determined mainly by accessibility at least in former periods and by the suitability of the conditions of life now and in former epochs. Though the Mediterranean Sea looks a formidable barrier on the map, it has not prevented North Africa from being mainly inhabited by species of Palaearctic origin, many of which have come into Mauretania

from Europe. This being so, one wonders why so many common European species which extend to South Spain, South Portugal or Sicily are missing in North Africa, the absence of certain Palaearctic types being a very striking feature of the Mauretanian fauna. As our various visits to Algeria were chiefly undertaken with the object of studying and collecting birds and Lepidoptera, and to a lesser extent mammals, though other classes were not entirely neglected, I will restrict my remarks almost entirely to the groups of animals which interested us most.

As you know, the most important contributions to our knowledge of the Lepidopterous fauna of Mauretania is due to an English Entomologist of great skill, H. Powell, whose results in observation, breeding and collecting have been so ably published by our Honorary Fellow, Mons. Charles Oberthür. I myself have received a large amount of material in fine order from Mons. V. Faroult, who has collected in many places of Algeria, during later years exclusively for me. And much has been done to explore the Lepidoptera by Mons. A. Nelva at Batna, the late Capt. Holl and my friend Dr. H. C. Nissen at Alger, besides numerous European Entomologists who have visited the country. The higher portions of the Atlas of Morocco may have some surprises for us, but I believe that the Algerian mountains are fairly well explored, though very much remains to be done in detail.

Those of you who have collected Lepidoptera in Algeria will probably have been struck like myself by the absence of many familiar species of European butterflies and moths. There are no *Limenitis*, *Neptis* and *Apatura* in North Africa; *Leucophasia sinapis* and *Anthocharis cardamines*, *Thecla ilicis* and *Laeosopis roboris*, *Vanessa io* and *V. urticae*, *Syntomis phegea*, *Lasiocampa quercus*, *Gastropacha quercifolia*, *Dendrolimus pini* and *Hippocrita jacobaeae*, to mention only some of the larger and familiar species, do not occur in Mauretania, though many of them are common in South Spain. The food-plants are there, and the climate is so varied in the plains and mountains of North Africa that these factors do not offer a plausible explanation of the lacunae in the Mauretanian fauna; nor would the straits of Gibraltar be a barrier

preventing these butterflies and moths from crossing over and becoming established on the southern side of the Mediterranean. As most of the absentees are species which extended their range after the glacial epoch from east to west, it is understandable that those forms which are rare in Spain have not reached Africa, but why species like our tortoiseshell, common in South Spain, should fight shy of Africa, while *V. polychloros* is abundant, must have a subtle reason as yet unknown to us. The Oleander Hawkmoth is even a more instructive illustration of this phenomenon of distribution which appears anomalous to us. This beautiful moth is very plentiful in the Ethiopian Region, inclusive of the Malagassic Province, as well as in Asia Minor, Western Central Asia and Western India southward to Ceylon; it has extended its range westward in the countries north of the Mediterranean and is an occasional visitor in Central and West Europe and Great Britain. In North Africa and Spain and Portugal where the food-plant is as abundant along the brooks and rivers as the willow is in northern Europe, the moth is as rare a visitor as in Germany or England; besides a few larvae found at El Kantara, Bône and Alger, I have no evidence that the species occurs in Algeria, although every collector searches for it on the oleander bushes. The country is accessible to our species, there is an abundance of food not eaten to any extent by other insects and left alone by mammals, and the climate appears at least as suitable for this tropical hawkmoth as the South of France, where the species is a permanency; why does the species not likewise establish itself in Algeria? The reason remains as yet obscure.

Another interesting absentee from the countries south of the Mediterranean is the genus *Parnassius*, which is represented in Italy and Sicily by two species and in Spain by one and might be expected to occur in Morocco and Eastern Algeria. I do not believe that the genus has reached North Africa, for the following reasons. The *Parnassius apollo* of the Sierra Nevada is evidently excessively rare, and may even have become extinct in recent years, which we may interpret as evidence that this southern locality was not very favourable for the insect. If that is so, an even more southern mountain

range, the Atlas of Morocco, can hardly be considered more suitable. As regards Eastern Algeria *Parnassius mnemosyne* is excluded as a possible resident, because the food-plant, *Corydalis*, is missing in that district. Moreover, Eastern Algeria and Tunis have many affinities with Sardinia and Corsica, and these two mountain islands have likewise no species of *Parnassius*. We may, therefore, conclude that *Parnassius* came from the East into Italy when Corsica and Sardinia as well as Mauretania were already isolated from Europe.

Other groups of animals offer corroborative illustrations of these phenomena of distribution. Amongst mammals the most striking examples of common European species the distribution of which stops short at the straits of Gibraltar are the wolf, the mole and the Arvicolid mice, such as the short-tailed field-mice, water-rat, bank-vole, etc., all of which are entirely absent from North Africa. The long-tailed field-mouse, the house-mouse and several European shrews have crossed over into Mauretania, why not a single vole? In the case of birds the Mediterranean can hardly be considered an effective barrier to their distribution, yet many European species which extend south to the northern shores of the Mediterranean are absent from North Africa. We mention the Blue Magpie, Snow Finch, Reed Bunting, Hedge Sparrow, Long-tailed Tit, Penduline Tit, Bearded Tit and others. If we knew the past history of the absentee species, we would also have, I think, the explanation of this remarkable kind of distribution, for the present-day bionomics of a species are built up on its past history, and barriers formerly effective are often still respected though they have dwindled down to a mere shadow. Take as an illustration of what I mean an example from near home. The crested lark is a bird common on the Continent and nesting freely on the French and Belgian coasts and yet does not come over to England except as an occasional straggler. The Channel is no real barrier to a lark; the biological conditions in the southern and eastern counties of England would be quite suitable; we should give the species protection and leave it unmolested, and nevertheless the birds stop short at the other side of the Channel,

where they catch, shoot and eat them. There obviously is inherent in this species a strong aversion to crossing the water, the explanation probably being that in postglacial times this southern bird found its biological boundary at the northern shores and now shies at a barrier which resembles in appearance, but not in fact, the original boundary of its range. The behaviour of migratory birds is a case of a similar kind. In Algeria we find large numbers of species which are winter visitors or pass through the country. Many of them are represented in Mauretania by resident local races, which are often so slightly different that only the experts can distinguish them, and it is quite natural to conclude—and formerly this was the general opinion—that many individuals born in northern countries remain in North Africa, where all factors are quite favourable for them. But the fact is they do not stay, apart from occasional specimens unfit for one reason or the other to undertake the flight across the Mediterranean. Why do they all go back to the north? The life of these migrants like that of the crested lark is governed by instinct, or to use a more lucid term, by inherited memory, one of the greatest forces in the life of animals inclusive of man. Bernard Shaw is quite right in saying that the opinions and actions of the average man are to a large extent based on the raw feelings emanating from our subconscious selves unchecked by considered judgment, and that applies as well to the actions of animals. The distribution of animals does not entirely depend on outward causes, but there are also psychological factors which must be taken into account.

When I use to-night the term Algeria, I do not wish to imply that this political term designates faunistically a unit separate from Tunisia and Morocco, or that the country is homogeneous in itself. Algeria as a whole differs much less from Tunisia and Morocco in fauna and flora than do the physiographically different districts of Algeria from one another. The tourist who visits Algeria in winter in search of sunshine and travels by rail or motor from the coast across the country to Biskra in the northern desert, traverses the three zones into which the country is faunistically and botanically divided in conformity with its physiography. These

natural zones stretch from east to west, their direction being determined by the general folding of the crust of the earth in the northern hemisphere of the Old World. They are (1) the Coast District or Tell, (2) the High Plateaux, and (3) the Desert or Sahara.

The Tell comprises the northern Atlas, the mountains of the Kabyles and the lowlands between the ranges and the sea. It is a region of wooded hills and mountains and green plains and valleys, with a climate warmer than that of the Riviera, mild in winter, pleasantly warm in spring and autumn and often disagreeably hot in summer. The vegetation is luxuriant, but so many tropical and subtropical plants have been introduced into the parks and gardens, where they thrive well, that the uninitiated visitor gets quite a wrong idea of the flora of Algeria. The town of Alger has a subtropical appearance on account of all the flowering trees and shrubs which adorn it, but the surroundings are purely Mediterranean. Evergreen Oaks, Cork Oak and Aleppo Pine are the prevalent trees in the woods, and the scrub or makis is likewise so similar to that of Southern Europe that, if you were suddenly transferred from a makis near Hyères to a makis in the Tell, you would not notice from the plants that you were south of the Mediterranean instead of north. In the open the olive tree is much in evidence everywhere, and the inevitable Australian Eucalypti are planted in many places to the disgust of the Entomologist. The dwarf palm (*Chamaerops humilis*) is one of the characteristic plants of the Tell zone. *Urginea maritima*, *Ornithogalum*, *Allium*, *Asphodelus*, various *Crocus* and *Iris*, *Cistus*, *Genista*, *Eryngium* and *Lavatera* may be mentioned from among the common plants which would catch the eye of a visitor from Northern Europe. As the country rises from sea-level to above 7000 ft., the fauna and flora vary much according to locality, and there are still many districts in the mountains where little collecting has been done. Accommodation in the hills is often missing in places which look most promising for the naturalist, and though one can go anywhere by rail, motor or mule, one would require to fit out a camp to explore the out-of-the-way localities, which is both cumbersome and costly. The average collector is confined to

places where there is some sort of hotel. The show places to which winter guests resort have good hotels, some first-class, some called first-class. After the war many have become much inferior to what they were in 1914, generally due to a compulsory change in management. Restricted as the collector is in the choice of localities, he will nevertheless get a true picture of the fauna of the Tell if he visits only a few of the better places in the hills. Nearly all that is most characteristic of the coast zone can be found on excursions from Alger. After having satiated his eyes and mind on the most interesting picture of life presented by the numerous races of man in varied garb which have congregated at Alger, and after having walked through the narrow streets of the native town up to the Kasbah, the old palace and fortress of the Dey of Alger, the Entomologist will be ready and long for a flowery hillside or green valley where his eyes might encounter something more delightful for him than even the picturesque crowd on the Place du Gouvernement. He can do no better than explore the valleys easily reached from Mustapha Supérieur; the rough ground near the golf course, and the woods, meadows and fields in the neighbourhood of Château Hydra, and perhaps visit the Forêt de Baïnen to the west of Alger and the sands and swamps between Maison Carrée and Cape Matifou. As early as January the Lepidopterist will find something worth collecting. Probably the first species that makes his heart beat—provided it is his first visit to Algeria—will be *Zygaena algira*, which is then already on the wing wherever Genista is plentiful. In spring and summer he will see the usual Riviera butterflies, often somewhat modified, *Gonepteryx cleopatra*, *Euchloë belia*, *Ganoris brassicae*, *Pararge egeria*, *Pararge megera*, *Epinephele jurtina*, *Thestor ballus* and *mauretanicus*, *Papilio machaon* and *podalirius*, and *Thais rumina*. But what he perhaps will be astonished not to find are the familiar *Melitaea* and *Argynnis* so prominent in the European fauna. The smaller *Argynnis*, with the exception of *lathonia*, do not occur in Algeria, and *Melitaeae* are very local. Apart from species of restricted range the fauna in the Tell of Eastern and Central Algeria is very uniform; what one finds in the east near Souk-Ahras you may expect to meet again in the

wilder surroundings of Alger; but if one goes farther west into Oran, new elements are found in the fauna, forms which either have come from Spain via Morocco and have not reached the Central and Eastern parts of the Tell, or have extended their range from the interior northward. To Entomologists who wish to collect in the Tell, Hammam Meskoutine in the East, Hammam Rirha in the Centre and Sidi-bel-Abbès in the West can be recommended. Though the individual aspect of these places is very different, they have much in common: deep gullies with almost impenetrable brushwood, the arable land tilled or turned into vineyards, the rocky hillsides a paradise of plants and animals, and the mountains covered with woods. Higher altitudes in the Tell are most easily reached from Les Glacières de Blida, which consists of a small hotel at about 4000 ft., quite first-rate for a collector who can dispense with the paraphernalia of large establishments. The hotel stands on a small plateau on the steep hillside, surrounded by oak woods where millions of larvae of *Catocala* may be seen in May and June and where many good species of moths will come to the lamp, such as *Apantesis oberthuri*, *Pergesa porcellus colossus* and *Notolophus splendidus*. Above Les Glacières is a fine cedar forest with a profusion of *Viola munbyana*, on which feeds the larva of the beautiful *Argynnis pandora*, at times quite abundant here, and above the forests there is a large expanse of grassland to the top of the mountain, which reaches a height of nearly 5400 ft. It is a fine collecting ground if the weather is favourable. But being directly above the plain of the Metidja and facing the sea, the place is very often in the clouds even when there is brilliant sunshine below.

Though the tourist may not be aware of it—and if he is, he need not trouble much about it—the fastnesses of the northern Atlas are the haunts of some large mammals. The leopard, striped hyaena, caracal lynx and jackal are still to be found, but they have become very shy. The lion used to be quite common in the Tell and in Eastern Algeria as far south as the Aurès Mountains, and it seems quite strange that one now can walk about with a butterfly net as the only weapon in places which less than forty years ago were still

infested by lions. How numerous the huge carnivore must have been in Mauretania is proved by the historian, who informs us that Pompey sent 600 and Cæsar 400 lions to Rome from North Africa. In 1880 ten were killed, and I believe a lioness was shot near Batna in 1893, which proved to be the last of the black-maned North African race of *Felis leo*. That the species could flourish in Algeria until quite recently was due to the low state of civilisation in which the country has been since the Arab conquest. The lion of Syria, Asia Minor and Greece became extinct ages ago.

The tailless monkey of Mauretania, another interesting species, is only found in a few places of the Tell; it is the same species which lives on the rock of Gibraltar, where it was probably introduced by the Moors. The term Moor, I may explain incidentally, does not designate a nigger, but a native of North Africa (Maurusia of the Greeks, and Mauretania of the Romans); Othello was a Mauretanian, not an Ethiopian. The Barbary monkey has its nearest relation in Japan and must be looked upon as a relict, the species having become extinct in other Palaearctic countries. It can best be seen in the Gorge du Chiffa near Blida, where it is protected, as elsewhere, against the scourge of the fauna in all countries, more especially those connected with South and Central Europe, viz. the man with the gun who indiscriminately kills everything that comes along, from a passerine bird upwards. These monkeys, though by no means tame, have no fear of man and come down from the woods to the little hotel in the gorge, where they are sure to find some food placed for them. The monkeys at the Gorge du Chiffa have split up into two troups or families which keep separate in the woods and visit the hotel, one troup in the morning, and the other in the afternoon. It is most interesting to observe them at close quarters and watch them show each other their babies and hear them express their satisfaction about the health and particularly cleanliness of the infants; the elderly mothers behaving very decorously, while the young members of the herd jump about like boisterous but good-natured children and the master of the family is always ready to attack any one who should venture to molest a member of the troup. In the Makis of the Tell the wild

boar is frequent in some places, and in broken country, *Herpestes*, *Hystrix* and *Genetta* may occasionally be seen. The small mammals are not numerous in the Tell as regards species. The three shrews recorded are of European origin and are typical for the Tell; only one is common, the white-toothed garden shrew of Europe, which reaches in Eastern Algeria the foot of the Aurès Mountains, while farther west it does not appear to have penetrated on to the High Plateaux, the explanation of its southward extension in eastern Algeria being that the district of Khenchela, where we found this shrew, is connected by a brook with a river of the Tell, the Oued Melleg. The long-tailed field-mouse, slightly different from the English and European forms, we obtained as far south as El Kantara, while the house-mouse and its near relation *Mus algirus* extend far into the desert, *Mus algirus* being excessively common in the oases of the Oued Rhir from Biskra to Tougourt. We find in the Tell also a mouse of an Ethiopian genus, *Arvicanthis barbarus*, the Barbary or striped rat, which is restricted to the Tell, where it is fairly common in grassland and cornfields. Its nearest congeners are found in the Nile countries, and we may therefore conclude that this *Arvicanthis* reached Mauretania from the east along the coast. The suggestion made by some authors that it came across the Sahara at a period when the river-beds of the desert had a richer vegetation than in our time must be dismissed as highly improbable. In fact, all the Algerian mammals which have Ethiopian affinities came from the east, not from the south, and most of them, like the lion, leopard, hyaena and porcupine, inhabited Western Asia, the striped hyaena being a West Asiatic species which has extended into East Africa and Mauretania. The birds of the Tell are of an essentially Palaearctic character with an admixture of some indigenous species and two forms of Ethiopian origin. But these Ethiopian birds, unlike the mammals, did not come from the Nile countries or Mediterranean Asia, but along the Atlantic coast and via Morocco. The Bulbul has its nearest relative in West Africa, and the *Telephonus* of Algeria and Morocco is a tropical African type. As a third example we will introduce here a bird which is not found in the Tell, but the distribution of which

is very instructive: the Palm-dove (*Streptopelia senegalensis*) occurring in the oases of the Sahara as a subspecies, *S. s. phoenicola*, is of West African origin. If this bird had reached Biskra and El Kantara from Senegambia across the Sahara, we should expect it to be found in all the oases of the desert. Its distribution, however, is different. The bird occurs only in the NORTHERN oases of the Sahara and does not go further south than Ouargla, being absent from the oases of the Central Sahara. This distribution shows clearly that the species travelled north in the Atlantic district and then extended east and south. The Guinea-fowl of Morocco, *Numida sabyi*, came the same way along the west coast. The commonest Reptiles and Amphibians of the Tell occur also in Europe, such as the Smooth Snake, the beautiful *Lacerta ocellata*, the Gecko, *Rana esculenta* and *Hyla arborea*. The number of species of insects which do not go south of the Tell except in Eastern Algeria, where the Tell is less well defined than in the centre, is considerable, and their affinities, particularly among the butterflies, are for the most part with Spanish forms. But affinities with Egypt in the east and Sicily, Sardinia and Corsica in the north are not absent in insects. As regards Coleoptera, we may mention that the genus *Carabus* does not occur in Algeria except in the Tell and Northern High Plateaux. The commonest species, which may be met with even in Mustapha Supérieur, is *Carabus morbillosus*, also found in Sicily and Italy. *Nebria complanata*, a West European carabid, occurring in Great Britain, is common at Alger, *Purpuricenus desfontainesi*, *Steraspis squamosa* and *Cleonus clathratus* point to Egypt and Syria. Of the Lepidoptera * confined in Algeria to the zone of the Tell I here give a selection (I omit Geometridae, Pyrales and "Micros," which I have not worked out as yet): *Thais rumina mauretanica*, *Aporia crataegi mauretanica*, *Pieris napi atlantica*, *Charaxes jason*, *Polygonia c-album* and *egea*, *Melitaea desfontainei* (West Algeria), *Melitaea cinxia* (West Algeria), *Epinephele janiroides*, *Coenonympha fettigi*, *Sphinx ligustri nisseni*, *Sph. pinastri*, *Haemorrhagia fuciformis*, *Zygaena seriziati*, *Z. theryi*, *Phalera bucephala*

* Cf. Nov. Zool., xxiv, p. 61 ff. (1917).

bucephalina, Lemonia vallantini, Ocnogyna pudens, Apantesis fasciata oberthuri.

Before leaving the subject of the Tell, we must mention a faunistic mystery which has puzzled Zoologists a good deal, and which will probably never be cleared up to everybody's satisfaction. You know from the history of the Punic wars that the Carthaginians employed elephants in battle and that Hannibal brought thirty-seven of them over to Europe and took them with his army over the Alps into Italy. Where did the Carthaginians obtain them? Some maintain that they were Ethiopian elephants which had been brought across the Sahara, an assumption we may reject without hesitation. Others have come to the conclusion that the elephant was indigenous in the forests of North Africa. If that was the case, one cannot understand (1) why the Carthaginians could not readily replace the losses, (2) why the native rulers who became powerful after the destruction of Carthage did not employ them in their wars, and (3) why so few remains are found! To bring Indian elephants to Mauretania was certainly a formidable task, but as Mithridates is said to have received Indian elephants, the task was surely not above the power of the sea-faring Carthaginians, and it appears, therefore, most probable that the Carthaginians introduced the Indian species and bred it, which would explain the comparatively small supply on which they had to rely. Lately, however, remains of a small race of indigenous elephants have been dug up in Algeria.

We now come to the second zone of Algeria lying to the south of the Tell and comprising the Southern Atlas and the High Plateaux between it and the Northern Atlas. The Southern Atlas is highest in the east, where it attains in the Aurès Mountains a height of over 7800 ft., and rises in the west again above 6000 and 7000 ft., being lowest in the centre. The country bounded by the two ranges is more or less flat, with hills here and there, and has an average altitude of about 3000 ft., falling towards north as well as south and being intersected west of Batna by the Hodna Mountains, which are a north-westerly continuation of the Aurès and join the mountains of the Tell, separating the plateau between

Constantine and the Aurès from the much larger one which extends from the Hodna Mountains westward into Morocco. With the exception of the higher mountains there is no forest; the vegetation is low, the rocks and hillsides are washed bare, and when it rains the water rushes away and cuts in the ground deep channels with vertical sides. The rivers thus formed have no connection with the sea, but pour their waters into lakes which occupy the depressions in the plateau. These Chotts, which are a characteristic feature of the country, usually dry up in summer and leave a deposit of salt; only near the Tunisian frontier and in the centre of the western plateau the rivers find an outlet to the sea. The plains of this zone of Algeria comprise about 30 million acres, of which a large percentage is arable and will no doubt be cultivated as colonisation goes ahead. The absence of forests and the consequent scarcity of water during the hot summer months are a great drawback to the agriculturist; but there is no reason why afforestation should not be taken in hand in time to come. At present the western plateau is almost entirely steppe country, while the eastern plateau has changed its aspect in recent years. When travelling from Batna via Lambessa to Timgad and further east to Khenchela, we traverse a district which in olden times used to be called the granary of Rome and which abounds in Roman remains. Under French rule this country is slowly recovering, from the point of view of the economist. Farms have sprung up, and broad acres of cultivated land are seen. But the farmer has to contend with great difficulties. The sudden changes from cold to warm in winter, frosts in spring when the vegetation has started growing, long droughts in summer, sometimes in several consecutive summers, hot dry winds from the desert, and occasional visitations by swarms of locusts do not tend to make the country exactly a paradise for the farmer. In the western plateau of the provinces of Alger and Oran, a large proportion is overgrown with Halfa grass, and here and there a suitable depression is sown with barley or millet by a nomad whose tents you will find in the neighbourhood. Apart from the settlements in places where there is a supply of good water, the country appears to a European a huge waste-land. The Entomologist, however,

if he strikes the right spot at the right time, will be of a different opinion. For him it is a land of riches, where he sees more treasures run and fly about than he can gather in. From mid-April to late in June when the low vegetation is at its best, the number of individual insects one sees in favourable localities is astounding. Unfortunately one cannot depend on finding these riches every year. When for a year or two an insufficient rainfall or entire absence of rainfall occurs, as it occasionally does, or when one arrives after the vegetation has been decimated by locusts, insect life is poor. Before going to the High Plateaux or the Desert for the purpose of collecting Lepidoptera, it is advisable to inform oneself beforehand about the meteorological conditions which have prevailed the winter and autumn before. In 1920, for instance, there was hardly any wild vegetation on the hills near Biskra and El Kantara and Lepidoptera were scarce, and in 1919 collecting was very poor around Batna. Our collecting tours on the High Plateaux have generally been successful; only when visiting Tebessa near the Tunisian frontier we struck cold and misty weather and had to leave after waiting a few days in vain for sunshine. Khenchela, likewise on the eastern plateau, at the foot of the Aurès, is a very good spot accessible by rail. The Hôtel de France is quite good enough for a collector, and the town has the great advantage of being on the collecting ground, which is good and varied. On the one side there are the wooded Aurès Mountains with the hot springs and rich vegetation of the Fontaine Chaude about 5 km. to the west of the town, while east, south and north the country is open and has a rich steppe fauna. Timgad, the most imposing of the Roman ruins of North Africa, cannot be recommended as a collecting ground; the surroundings are too uniform, too open and wind-swept. Lambessa and Batna, on the other hand, offer a greater variety of localities with a prospect for the collector of obtaining the special treasures of the Aurès Mountains in addition to the insects of the open plains. The best spot in which we have collected was Guelt-es-Stel on the line from Alger to Laghouat, about halfway between the northern and southern Atlas. Guelt-es-Stel is not a village, but a wayside bordj or caravanserai, where the kind and efficient

French family which occupied it made us very comfortable. It lies in a defile of a range of hills, which offer excellent collecting grounds. It was here that we made for the first time the acquaintance of *Anthocharis pechi* in the field, a species which used to be very rare in collections until quite lately. Unfortunately the bordj has been given up since the railway down to Djelfa has been completed, and there is now no accommodation anywhere near the place. A small hotel for naturalists ought to be attached to the railway station at Guelt-es-Stel.

The most western place on the High Plateaux visited by me is Aïn Sefra in the Southern Atlas of Oran, not far from the Moroccan frontier. It is an out-of-the-way place which is quite outside the beat of the sight-seeing tourists and lies between two high mountains, which attain over 6000 and 7000 ft. An immense sand dune comes up from the Sahara, which explains the occurrence of a number of desert species in this locality. When we were there in 1913, we were fairly lucky with collecting, while Monsieur Faroult, who stayed at Aïn Sefra a whole summer collecting for me, or trying to, got very little in consequence of the effects of drought and the ravages of locusts, two plagues which destroyed insect life for the time being. The province of Oran inclusive of the Tell is altogether less favoured with rain than Central and Eastern Algeria; even the districts near the coast with very fertile soil, like the plain of the River Chélif, cannot be depended on to give a fair harvest every year. In passing I will refer to a curious fact which may be only a coincidence or may have deeper significance. The Tell of Oran has less woods than Central and Eastern Algeria, and the open country, which could bear numerous trees, as it does further east, is practically bare of them. The inhabitants of the Oranese Tell are chiefly Spaniards, and the Spanish peasant has an aversion to trees. The absence of shade has certainly a good deal to do with the dryness of the soil and is possibly one of the reasons why Oran suffers so often from drought. If that is so, giving way to a subconscious aversion would here find its immediate punishment by the destruction of the crops by drought. I leave this point to the psycho-analyst to work out.

The fauna of the High Plateaux is essentially a steppe fauna, its composition recalling Egypt, Palestine and Syria. In the province of Constantine many species of the Tell have penetrated south into the Aurès Mountains, while in the west forms of the High Plateaux have extended into the Tell of Oran on account of its dry climate.

Apart from the Barbary sheep which the Aurès Mountains have in common with the mountains of the Sahara, and the lion which occurred from the coast into the Southern Atlas, but not in the desert, the mammals characteristic of the High Plateaux are mostly rodents, of the genera *Meriones*, *Jaculus* and *Gerbillus*, all abundantly represented in Egypt and the steppes of Western Asia and also occurring in the Sahara in species generally different from those of the High Plateaux. The *Meriones*, of the size of rats, are the commonest of all, and their burrows are met with whichever locality one visits, a number of holes being together on a small area as in the case of the continental short-tailed field-mouse. The burrows are favourite resorts for *Blaps*, toads and snakes, which one must expect to find in the traps instead of *Meriones*. A species of *Ictonyx*, black and white, belonging to the marten tribe, is found on the High Plateaux; it is closely related to an Egyptian species. The stink glands under the tail are strongly developed, and in skinning a specimen one has to be careful not to cut into the glands. We obtained a couple of specimens of this pretty marten at Guelt-es-Stel, where our collection of small mammals was particularly large and varied, and we threw the *Ictonyx* glands in the yard where some pigs walked about and used to devour the carcases of the specimens we had skinned, and everything else from the animal kingdom, be it a beetle or a snake. The pigs inspected the *Ictonyx* glands, turned and walked away; that was their verdict. We buried the glands outside in the sand. Small mammals generally come out of their burrows or hiding-places at dusk and one does not often see them in bright sunshine. However, there is one species on the High Plateaux which the Entomologist is sure to encounter when collecting in rocky ground, that is the peculiar Elephant shrew (*Elephantulus*), also an Entomologist, but of

a different kind, an insectivore with a long nose and long hind-legs, which roams about the rocks and does not seem to have a definite abode except when it has a litter of young. The two species or subspecies which occur in Algeria are only found on the High Plateaux, and the adjacent district of the desert, not extending into the Tell except at Oran. It is an Ethiopian genus found in the Nile country and tropical Africa, as well as Morocco. It is most interesting to observe that the Siphonaptera collected on the High Plateaux, apart from some Palaearctic genera extending far into the desert with their hosts, are mostly identical with or closely allied to Egyptian and Sudanese species, as is also the case with the Siphonaptera collected in the desert. The genus prevalent in these districts is *Xenopsylla*, to which belong the rat-fleas transmitting bubonic plague; it is an essentially Ethiopian genus which is not found in the Tell of Constantine and Alger except on rats in port towns. The Elephant shrew does not seem to have a flea. We have collected many specimens of the mammal and never found a parasite on it. Among the butterflies of the High Plateaux the Pierines and Satyrines are the prevalent groups, which at times occur in many species and large numbers of individuals. *Satyrus abdelkader* is the most conspicuous of them, and restricted to the Plateaux and some localities in Northern Oran. Several species of *Thestor* are found besides the Mediterranean *Th. ballus*, and *Cigaritis* is represented by three species. Even more interesting than the butterflies are the moths, which show a strong admixture of Syrian affinity. In the spring the caterpillars of *Lemonia*, *Lambessa* and other Lasiocampids abound, and the lamp attracts many species of Noctuids rare in collections : *Cleophana*, *Cucullia*, *Calophasia*, *Eublemma*, etc., all genera essentially Palaearctic. The Aurès Mountains with their extensive woods are not so different in the Lepidoptera from the rest of the central faunistic zone as one should expect. Here and in the Kabylie occur two remarkable forms of *Argynnis*, of which *Argynnis auresiana* is a type similar to the Spanish *A. cydippe chlorodippe*, and which on that account one should expect to occur in the Western Tell Mountains rather than in the Kabylie and the Aurès. *A. auresiana*

differs in structure more from *chlorodippe* than this does from Central European *cydippe* L. (1761) = *adippe* L. (1767), and is one of the innumerable instances of a geographical race having become modified in structure as well as pattern. The second species is *Argynnis paphia*, found in the same mountains, but this species, unlike *A. cydippe*, does not occur in Southern Spain. The Algerian *A. paphia dives*, therefore, did not extend into Mauretania from the west. Its occurrence in the Kabylie renders it almost certain that it reached Africa via Sicily. The Aurès are the chief locality for a third butterfly, this time a species of Ethiopian origin, *Teracolus daira nouna*, which is also found in Oran and in many rocky hills of the desert wherever the food-plant grows (*Capparis*), its range extending into East and West Africa.

The Avifauna of the High Plateaux contains many interesting species, of which I will mention only a few. The largest of the Palaearctic birds, the Bearded Vulture, still occurs in the mountains, but has become rare of late. We have a few specimens in the collection obtained at El Kantara and Djebel Taia. The huge bird is occasionally seen in the air at El Kantara. The red-billed Chough also nests in the rocks of the High Plateaux, the same species as in Ireland and the West of England; it is quite common at El Kantara, where flocks of them come down into the valley to feed. The Entomologist's attention will be drawn off from his quest by the note and lively behaviour of a black bird with white tail, a Wheatear (*Oenanthe leucura*), which is common among the rocks, and if he has an eye for curiosities in nature he may give up insects for a little while and hunt for the nest of this bird. There under a rock is a mound of pebbles which look as if they had been washed by rain from underneath the rock, the mound is so high as almost to close up the cavity under the rock, and behind, well concealed from view, is the nest. There are other birds in the steppe and desert which have a similar habit, f. i., the lark *Rhamphocorys* places in front of its nest a wall of stones which is about as high as the nest and which does not conceal it (on the contrary, attracts the attention, at any rate, of the human being). The pebbles are gathered by the bird in the neighbourhood, and the object

of the operation is apparently to create a screen against the sand which the wind drives along. In the Algerian Sahara, where the winds come much more frequently from the east than from the west, the lark, according to Dr. Hartert, builds the wall on the east side of the nest. It would be most interesting to have observations on this point from the whole range of the various species which have this instinct, as probably in a district with west winds prevalent the wall would be on the west side. *Oenanthe leucura* occurs also in Spain, but there nothing is known of a building talent. If it should be true that the species has dropped the habit in that country, it would be a most instructive instance of the adaptability of the mind. Something of that kind we find in the Algerian *Papilio machaon*. As you know, the swallow-tail is a Palaearctic offshoot from an American stock and its larva feeds on Umbelliferae, as do the larvae of the nearest relatives in the Nearctic Region. In Western North America, however, there are two species (*P. bairdi* and *P. indra*) of which the food-plant is *Artemisia*, a composite. Now, in Algeria *P. machaon* usually feeds on Umbelliferae, but in very dry places or when the season is exceptionally dry, it takes to *Retama*, which can stand the drought. We found the caterpillars on this plant to the east of Khenchela, and Monsieur Le Cerf observed them on *Retama* near Alger in the dune district of Maison Carrée. *Retama* belongs to the Papilionaceae, a family rather remote from the Umbelliferae and Compositae. This instance of a new adaptation on the part of the swallow-tail seems to me worth recording.

I append here a list of the more interesting Lepidoptera found on the High Plateaux grouped under four headings :—

1. Lepidoptera exclusively found on the High Plateaux.

Euchloë tagis pechi (Stdgr.), *Satyrus briseis major* Oberth., *S. powelli* Oberth., *Melanargia syllius pelagia* Oberth., *Zygaena loyselis* Oberth., *Z. marcouna* Oberth., *Ichthyura pigra powelli* (Oberth.), *Nygmia phaeorrhoea xanthorrhoea* (Oberth.), *Lambessa staudingeri* B.-Baker, *Lemonia philopalus* Donz., *Holcocerus powelli* Oberth.

2. Lepidoptera found on the High Plateaux and in the Tell, but not in the desert.

Papilio podalirius feisthameli Dup., *Euchloë belia* (L.), *Gonepteryx rhamni meridionalis* Röb., *G. cleopatra* (L.), *Vanessa polychloros erythromelas* Aust., *Argynnis maia seitzi* Fruhst., *A. auresiana* Fruhst., *A. paphia dives* Oberth., *Melitaea aetherie algirica* Rühl, *M. phoebe punica* Oberth., *Satyrus prieuri* Pierr., *S. abdelkader* Pierr., *Melanargia ines* (Hoffm.), *Coenonympha arcanioides* Pierr., *Amorpha populi austauti* (Stgr.), *Smerinthus ocellata atlantica* Aust., *Pergesa porcellus colossus* (Bang-H.), *Celerio nicaea castissima* (Aust.), *Zygaena favonia* Frr., *Z. algira* Dup., *Procris globulariae notata* (Zell.), *Dicranura vinula delavoiei* Gosch., *Liparis atlantica* (Ramb.), *Pachygastria trifolii* (L.), *Agrotis nisseni* Roths., *Euxoa mauretanica* (Bang-H.), *Metopoceras omar* (Oberth.), *Catocala oberthuri* Aust., *Hypomecia quadrivirgula* Mab.

3. Lepidoptera found on the High Plateaux and in the Sahara, but not in the Tell.

Euchloë charlonia (Douz.), *E. falloui* (All.), *Teracolus evagore nouna* (Luc.), *Phragmatobia breveti* (Oberth.), *Cossus aries* Püngl., *Dyspessa suavis* Stgr., *Euxoa imperator* (Bang-H.), *Pseudohadena roseonitens* (Oberth.), *Amephana warionis* (Oberth.), *Cleophana chabordis* Oberth., *Autophila maura* Stgr., *Grammodes boisdeffrei* (Oberth.).

4. Lepidoptera found in all three faunistic districts of Algeria.

Papilio machaon (L.), *Ganoris rapae mauritanica* (Verity), *Leucochloë daplidice albidice* (Oberth.), *Colias electo croceus* (Fourcr.), *Pyrameis cardui* (L.), *Melitaea didyma* Ochs. (several subsp.), *Acherontia atropos* (L.), *Herse convolvuli* (L.), *Celerio euphorbiae* (L.) (subsp.), *Notolophus dubia* Tausch, *Lambessa decolorata* (Klug) (subsp.), *Scotogramma trifolii cinnamomina* Roths., and others.

Though the Southern Atlas range belongs faunistically to the High Plateaux, its southern foothills have the aspect, and form part, of the desert. In two places, at Aïn Sefra in the west and at Bou-Saada in the centre, the desert has penetrated into and beyond the mountains and with the sand also the fauna and flora. There are two main routes into the Sahara from the Tell across the High Plateaux: the eastern one leading via Batna and El Kantara to Biskra,

and the more western one via Boghari and Djelfa to Laghouat. The traveller from the green north of Europe, when passing through the gate of the desert at El Kantara, enters into a country almost contrasting as much with his own home as land with water, a new and strange world. At El Kantara the first oasis of Date-palms greets him, and his eyes roam over bare hills which appear to him as a symbol of death; he is now in the Sahara, a broad desert belt stretching from the Atlantic Ocean eastwards and continued across Asia to near the shores of the Pacific. The damp north and north-west winds deposit in the Atlas Mountains the water they carry from the Ocean and Mediterranean, and the south-west winds become dry in Senegambia and the southern hills of the Sahara and sweep north without bringing relief to the thirst of the desert lands. When desiccation has once set in and the population does not or cannot counteract the disastrous effect the drought has on the vegetation, the process rapidly increases in intensity and sand replaces vegetation and conquers the country, just as in damp climates forest vegetation will cover the ground if unchecked. In Central Asia, at Buchara, the gradual destruction of the country by the sand has been going on in our time, settlements now being buried which were flourishing a few generations ago. There is little rain in the Sahara and what there is cannot be depended on, and when a storm breaks over the desert the water rushes away down the gullies of the hills or sinks deep into the sand. There is a system of rivers in the Sahara, but only the rivers which descend from the Atlas and are torrents when the snow melts, have running surface water all the year round, at least in their higher reaches. The oases are in the river beds or near them, and their irrigation together with the dry air and the permeable soil are the cause of the rapid disappearance of the water from the surface. The water continues to run below the surface on an impermeable bed, and in many cases is cut off from the surface by a layer of gypsum, which must be broken through in order to reach the water. Here and there a pool is met within a river bed, and an exceptionally rich vegetation in a depression is always a sign of water not far from the surface. None of the rivers

reach the sea, they pour their waters into Chotts as on the High Plateaux, but at most times the surface water has given out long before the Chott is reached.

The Sahara of Tunisia and Algeria—we know very little of the Sahara south of Morocco—may roughly be divided into an eastern Sandy Desert south of Biskra, and a western Stony Desert south of Laghouat.

When coming from the High Plateaux at over 3000 ft. above the sea, and going via Biskra into the sandy desert to nearly 100 ft. below the sea, and seeing the more or less dried-up Chotts surrounded by an enormous waste of sand, nothing is more natural than the conclusion that one is on ground which once was the bottom of a sea. This was indeed the opinion for long entertained about the nature and origin of the Sahara, and this opinion led to the belief, after the successful cutting of the canal of Suez, that the Sahara could be flooded by cutting through the coast barriers in Tunisia and Morocco. Speculation was rife as to the effect the sea thus re-created would have on the climate of Europe, and opinion was much divided for and against the undertaking. The project was based on ignorance. The Chotts may have been larger and more numerous in the Sahara in former times than at present, but the Sahara has never been part of the bed of the ocean and cannot possibly be flooded, the proposal being only feasible as regards the low-lying Chott district between Biskra and Tougourt. Channels cut through the coast barrier of Tunisia from the gulf of Gabès and through the ground which separates the Chotts and is above sea-level, would result in the creation of a comparatively small inland sea, the influence of which on the climate of the Sahara as a whole would be negligible. The northern Algerian and Tunisian desert no doubt would benefit by such an inland sea, though even this benefit would be rendered illusory, because a large number of the low-lying oases would have to be sacrificed. The project appears to be outside practical economics.

The low-lying Sahara south of Biskra is essentially a sandy desert or clay, but there is in places also firmer ground which bears a richer vegetation at times than the sand-dunes,

on which hardly anything else is found but salsolaceous plants and tamarisk and a species of *Orobanche* living on their roots. The immense masses of moving sand which have accumulated in the low-lying desert mainly through the action of the wind which sweeps the sand away from the higher-lying ground, is a great drawback, which, however, is not without its compensation. In this region, though it looks excessively desolate away from the oases, there is under the sand in the depressions plenty of water which can be tapped. By means of artesian wells, the French have increased the number of date-palms enormously, and thus have added greatly to the comfort and wealth of the natives, as well as the French settlers. When I visited this part of the Sahara in 1909, we travelled by caravan from Biskra to Tougourt and thence east to El Oued, traversing east of Tougourt the country of large dunes of moving sand, which looked most formidable. For an Entomologist such a sandy waste far away from the vegetation of an oasis at first sight appears to be a hopeless locality; nevertheless on favourable nights the lamp attracts a fair number of insects. When collecting in the Sahara one must discard the idea of large numbers of species, to which one has got accustomed in the mountains of Europe, the Tell and even on the High Plateaux; on the other hand, the species one does get on the sands are generally treasures, and that makes up for this paucity in specimens. El Oued is a good example of a type of oasis in deep sand. The surface sand and the layer of gypsum below it have been removed in places, and the palms been planted in the moist sand lying on the bottom of the river bed. The oases thus created are hollows 20 to 30 ft. below the surrounding country, and from some distance the tops only of the palms are visible. Instead of the water being raised to the surface, the oasis is sunk to the level of the water. It took us about twenty-eight days to travel from Biskra and back; but our progress was much slower than that of a travelling caravan, as we collected wherever we camped. Now there is a railway from Biskra to Tougourt, which traverses the distance of 110 miles in about nine hours, instead of five days, if the engine does not break down; there is no speed limit in the Sahara. And as the result of the railway, Tougourt rapidly loses the charm of a native

settlement isolated from Europe by a wide stretch of desert. The influx of tourists is so great that the trains are usually crammed, and the hotels too small to accommodate the visitors.

Even in winter, though the temperature in the Sahara is generally hot in daytime, the heat is not oppressive, the air being so very dry that one stands a high temperature much better than in the Tell. After a strenuous day one is pretty dried up and thirsty, and I agree with the writer who said that a great thirst is the most unpleasant sensation, and the quenching of it the most delicious. The best time for moths in the northern desert is May and June, but unfortunately that is also the time when the malaria begins to appear and renders a longer sojourn in any oasis rather dangerous. It is advisable for an Entomologist to select a locality with firm ground such as Chegga, two stations below Biskra, where tufts and bushes of hardy perennials cover the ground, affording food for caterpillars even in very dry years.

To the west of the sandy desert the ground gradually rises to form a kind of plateau of a considerable average height, where the wind has swept the sand away from the rocky ground into the depressions and where barren hills approach 3000 ft. in height. This plateau, which does not descend to below 1200 ft., is traversed from north to south by the route Laghouat-Ghardaia. The territory is very different in appearance as well as flora and fauna from the eastern sandy desert with its monotonous salt flora, and here it is that many Palaearctic species have penetrated farthest south into the Sahara. The railway, fortunately, has not yet reached the desert in this western district, but, as it will be completed as far south as Laghouat in the near future, the country of the Mzab will be spoiled by the crowds of tourists as much as Biskra is to-day and Tougourt will be in a few years. I visited Ghardaia in 1911, collecting on the way in many places.

The fauna of the Sahara as a whole is composed of three elements: genera and species derived from Tropical Africa, genera and species of Palaearctic origin, and genera and species of the desert belt. While the southern Sahara and its oases have an Ethiopian fauna, the northern districts of the Sahara are much more Palaearctic than Ethiopian. All classes of animals tell the same tale, the farther you go into the Sahara

whether from the north or from the south, the poorer animal life becomes. The effect of penetration from the north and south is less and less evident as the conditions of life become more and more unfavourable. The gazelles and antelopes of the Northern Sahara are species distributed eastward into the Nile country, or closely allied to such. The Bubalis seems to have disappeared from the Algerian High Plateaux and desert, the Dorcas gazelle, however, is still encountered at the foot of the Atlas, Loder's gazelle is confined to the sandy desert, and so are the Addax and Mohr. In the bare southern range of the Aurès the Barbary sheep is found, a species also occurring in the rocky hills of the desert in many places, its most northern habitat being the ridge of rocks running east and west from El Kantara, to which mountains a third gazelle, *Gazella cuvieri*, seems to be restricted. The jackal and hyaena the desert shares with the rest of Algeria, while the fennec is only found in the sandy desert, all three Carnivora extending east into the Nile country and beyond. To all these large animals there is an "If" attached; if they have not already been exterminated in most localities where they formerly abounded, they have become rare, and will not long survive in the neighbourhood of the settlements, with the exception probably of the jackal. This is an inevitable fate, I fear, in a country like Algeria. If a species has become rare and therefore unfamiliar, the first impulse of the human being who sees a specimen strange to him is to kill it. That is so even in Great Britain, where the love of nature is more deeply imbued in the population than anywhere else. The Arab does not kill for the love of killing, while on the other hand he is the most terrible pot-hunter, sparing neither young nor old in and out of season. The history of the ostrich in Algeria is an example in point. Though a bird, the ostrich lives the live of a ruminant mammal, and formerly occurred all through the Hauts Plateaux as far south as Ouargla. As late as the middle of the last century it was still abundant in the high stony desert south of Laghouat, where Tristram saw it in 1859. Though a prize coveted by the Arab hunter, the ostrich had held its own during all the centuries; but when the light of civilisation was brought to the desert in the shape of a conquering army, the drawbacks of civilisation also were imported and the first victims were the

freedom of the natives and the ostrich. We must never forget that where there is light there is shadow. General Marguerite tells us that he assisted at the killing of many dozens of this grand bird, of which nothing is left in Algeria but broken pieces of egg-shells. Must I add that there are no authentic skins of this wild bird of North Africa in collections?

The distribution of the small mammals of the desert is similar to that of the large ones, with this exception, that at least three species occur also on the High Plateaux and in the Tell. Of these the European house-mouse is no doubt of recent introduction, and its near ally, *Mus algirus*, evidently is restricted in the desert to the oases of the Oued Rhir, where it is much commoner than even in the Tell, for instance at Tougourt; this likewise may be an accidental immigrant of recent times, as the Saharan specimens (and their flea) are not different from those collected in Northern Algeria. The third species is *Dipodillus campestris*, ranging from the coast deep into the desert in several races. This species was very common at Djama, north of Tougourt, living together with *Mus algirus* in the walls built of palm fronds and mud around the palm-gardens. The mammal most characteristic for the sandy desert is *Gerbillus hirtipes*, a pretty species with ochreous upper- and white under-side. Its foot-prints are met with everywhere on the hillocks of sand formed around the bushes of *Limoniastrum*, on which the animal feeds, and the burrows in which it passes the day are in these hillocks, the inside of which is cool.

The birds most in evidence near the settlements are undoubtedly the larks, beautifully adapted to the colouring of the ground on which they occur, as is the case with so many mammals and birds of the desert. In the palm oases, the palm dove and turtle dove are seen and heard, while the region of the Chotts is the home of the fine *Hubara* bustard. On the sand hillocks crowned with *Tamarix* or *Limoniastrum* may be seen some small desert birds like *Oenanthe* and *Crateropus*, and in the stony desert sand-grouse of different species occur. Reptiles are fairly well represented in the desert, all species of wide distribution, but often adapted in colouring to local conditions. The horned viper, which buries itself in the sand, only a portion of the head protruding, may become dangerous

to the Coleopterist who grubs about in the sand near tufts of plants, the snake springing forward when disturbed. It lies in the sand waiting for a small bird or mammal to approach within reach of its poison fangs.

The number of moths not yet found outside the Algerian Sahara is not inconsiderable, but there are no butterflies which as species are restricted to the desert, the butterflies all being immigrants from the north as regards the northern districts of the desert and from the south in the southern districts. *Danais chrysippus*, the common Ethiopian species, occurs as far north as the southern Oued Mya, but reaches neither Tougourt nor Ghardaia. In the same southern district occurs *Pieris glauconome*, a species of the Nile countries extending to East Africa, Arabia, Persia and further east. Among the butterflies of northern origin which have developed into special desert forms the most conspicuous are *Papilio machaon*, *Euchloë falloui* and *Melitaea didyma*. The larva of *P. machaon* from the desert resembles the larva of *P. hospiton*; it would be most interesting to breed in Europe two or three generations from chrysalides gathered at Bou-Saada or further south and find out whether the caterpillar would throw back to the ordinary European form. The moths special to the Sahara are much more numerous; we mention *Liparis oberthuri* Lucas, *Casama uniformis* Roths., *Chilena hilgerti* Roths., *Ch. geyri* Roths., *Phryganopsis unipuncta* Hamps., *Nygmia charmetanti* (Mab. & Vuill.), *Athetis oberthuri* Roths., *Euxoa hoggari* Roths., *Hadula pulverata* (Bang-H.), *H. griseola* (Roths.), *Crypta rosacea* Rebel, *C. leucoptera* Hamps., *Anydrophila sabourodi* (Lucas), *Anumeta sabulosa* Roths., *A. major* Roths., *A. straminea* (Bang-H.).

The beetles most commonly observed in the desert are the Tenebrionidae and some Coprophagidae, besides species of *Cicindela*, *Graphipterus*, *Anthia* and in the Chott district *Scarites* and *Megacephala*. The *Megacephala* typifies a distribution common to many species and genera of animals, this large Cicindelid, of nocturnal habits, reaching into Spain and going eastward as far as Mesopotamia. In the oases of the desert a Longicorn beetle, *Polyarthron pectinicornis*, is found in the root-stocks of the date-palm; it evidently does not occur in the northern oases of El Kantara and Biskra, but is known to

occur at Bou-Saada, Aïn Sefra, Tougourt, Ghardaia, etc., nearly every group of oases having its own subspecies; the species is distributed from Senegambia and Morocco to Tunisia, a number of other species inhabiting Egypt, Persia and Central Asia.

The aquatic fauna of the desert naturally is poor in species. Pools and wells are few and far between, and the Chotts are too salty and dry up to a large extent. However, the water which there exists is not entirely devoid of animal life. When the first artesian wells were struck in the region south of Biskra, the engineers were not a little astonished to find fish, a crab and snails brought up by the stream of water from the deep underground, and they were much puzzled to observe that none of the species were adapted to a life in the dark. We now know that the underground rivers and lakes are connected with open wells, ponds and little lakes, the breathing holes of the subterranean water, which are found here and there in the same region, and that the species thrown up in the artesian wells live a normal life in these open waters. The brooks and ponds in the oases are usually full of fish, which are left unmolested by the Arab, who is not fond of fish as an addition to his diet. Some of the desert fish have the peculiar habit of protecting the young by letting them take refuge in the parents' mouth.

We will not leave the Sahara without saying a word about the domesticated animals of the native population and their influence on the wild flora and fauna. The most prominent features of the landscape for the tourist new to the country are the vastness and desolation outside the oases and the strange appearance of the most useful domestic animal of the desert, the camel, a species not of African, but of West Asiatic origin. The Arab population of Southern Algeria is a comparatively modern influx into the country, younger than the settlement of the Saxon in England, and the camel was already a domestic animal of the Berber tribes of the Sahara before the Arab arrived, whereas the horse and donkey were introduced into Mauretania by the invading Arab armies. Though the numbers of the camels in the Sahara are large and the animal when feeding often pulls up the plants with their roots, its destructiveness of plant life is nothing like that of the herds of

sheep and goats which browse on the scanty vegetation. Where the ground is scoured by the flocks from time to time, no luxuriant vegetation has any chance, and only plants protected by long sharp spines, like *Zizyphus*, can withstand the ruminants and form low sparse clumps of scrub. The nomads trek with all their belongings from pasture to pasture and when in the spring the weather gets hot and the feeding grounds of the Sahara begin to dry up, large caravans pour from the desert on to the High Plateaux through the passes of the Southern Atlas, and during the summer the Plateaux have to support all this cattle from the desert in addition to the herds of the natives and Europeans who have permanently settled on the Plateaux. The effect on the vegetation is not difficult to imagine nor difficult to ascertain. Seeing the crowds of sheep and goats on the waste lands of the High Plateaux one wonders that these herds find food enough on the pebble- and rock-strewn hills and that any plants can recover, though their roots may run deep down in the crevices of the rocks. The fact is that in years of exceptional drought the herds don't find pasture and the cattle perish by the thousands, as in 1919 and 1920, when in places the nomad took again to brigandage as in olden times in order to save his life. Nature revenges itself on a state of civilisation which is stagnant and remains in the old channels when the larger population, larger flocks, reclaiming of arable land by new settlers who introduce new implements and altogether new conditions of life, demand adaptation to these altered circumstances. That applies not only to the nomad of the desert, but with him the matter will soon become acute when agriculture and afforestation is more extensively taken in hand on the High Plateaux; then the summer pasture grounds of the Nomads of the Algerian Sahara will be no longer available for him.

I will now conclude this address, which had to be of a somewhat cursory nature. It is, as it were, an excursion into a country full of interest for the naturalist, and as on an excursion one does not see everything or catch every species there may be, I trust you will forgive me for omitting many points of importance. I thank you very much for listening to me patiently.

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ERRATA.

TRANSACTIONS.

Page 63 (Table) line 10 from bottom, for *Acmoeodera* read *Acmaeodera*.
Page 153, line 22 from top, for *Plocionus* read *Plochionus*.
Page 439, line 15 from bottom, for *cassive* read *cassiae*.
Page 439, line 14 from bottom, for *Haemophloeus* read *Laemophloeus*.

PROCEEDINGS.

Page xxx, lines 19 and 23, for *elutho* read *eleutho*.

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THE ENTOMOLOGICAL SOCIETY OF LONDON

THE FELLOWSHIP AND FEES.

Fellows pay an Admission Fee of £3 3*s*. The Annual Contribution of £2 2*s*. is due on the first day of January in each year, and is payable in advance.

All Fees should be paid to the Treasurer, Mr. W. G. Sheldon, at 41, Queen's Gate, S.W. 7, and *not to the Secretaries.*

Fellows desiring to pay their Annual Contribution through their bankers can obtain an official form of banker's order by applying to the Treasurer.

Fellows whose Contributions for the current year have been paid are entitled to receive the publications of the Society free of charge. Further copies may be purchased at reduced prices by applying to the Librarian.

Forms of application for Fellowship, copies of the Bye-laws and the List of Fellows may be obtained from the Secretaries.

MEETINGS AND EXHIBITIONS.

Intending exhibitors are required to send in their names and the nature of their exhibits to the Secretaries *before noon* on the day of the meeting, in order that they may be called upon from the chair. Descriptive notes of all exhibits should be handed to the Secretaries *at the same meeting* for printing in the Proceedings. If the lantern is required, a week's notice must be given.

Fellows resident abroad, or who are otherwise unable to attend, are reminded that any specimens, notes, or observations they may send to the Secretaries will be considered by the Council, with a view to exhibition or reading at the meetings of the Society.

PAPERS AND ILLUSTRATIONS.

Fellows desiring to communicate papers to the Society must send the full titles of such papers to the Secretaries at the Society's rooms, 41, Queen's Gate, London, S.W. 7, at least fourteen days prior to the date of the meeting at which it is proposed that such papers shall be read.

Authors proposing to illustrate their papers should communicate with the Secretaries before the drawings are executed. The Council recommend that the size of the work on plates should be limited to 6¼ ins. by 4 ins., and in no case will it be allowed to exceed 6½ ins. by 4¼ ins.

Attention is called to the Instructions to Authors issued with Part I of each volume, which may also be obtained at the Office of the Society. Inattention to these regulations may involve an author in considerable expense.

WANTED.

The Society desires to purchase volumes or parts of the Transactions for the years 1907, 1908, and 1912.

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MEETINGS

TO BE HELD IN THE SOCIETY'S ROOMS

41, Queen's Gate, S.W. 7

Session 1922–1923.

1922.

Wednesday,	April	5
,,	May	3
,,	June	7
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1923.

,,	January (Annual Meeting)	17
,,	February	7

The Chair will be taken at Eight o'clock.

THE LIBRARY

is open to Fellows and their friends every day from 10 a.m. to 6 p.m., except Saturdays, when it closes at 1 p.m. On the nights of meeting it remains open until 10 p.m.

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